AMERICAN MACHINIST

JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 13, No. 1. WEEKLY. | NEW YORK, THURSDAY, JANUARY 2, 1890. | $2.50 per Annum. SINGLE COPIES 5 CENTS.

COPYRIGHT 1889, BY AMERICAN MACHINIST PUBLISHING COMPANY. For Sale Everywhere by Newsdealers. ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

10-16 Foot Boring and Turning Mill.

The illustration given herewith is of a boring mill built by the Betts Machine Co., Wilmington, Del.

It will take in work under the cross-rail six feet in height, and with the housings in the position shown in the cut, will bore or turn work 10 feet 6 inches diameter. Provision is made, however, for moving the housings back on the bed by power, so that the mill will take in work up to 16 feet diameter. The bed is extended out behind for this purpose, and blocking out pieces are provided to go between the saddles and the index plates by which the bars are again brought out to the center line. Two saddles are provided, one of which can be brought over the center of the table, and the other as near it as is ever needed on such a machine.

The table or face-plate is 7 feet diameter, and has 60 changes of speed, 20 of which can be made without leaving the working side of the machine.

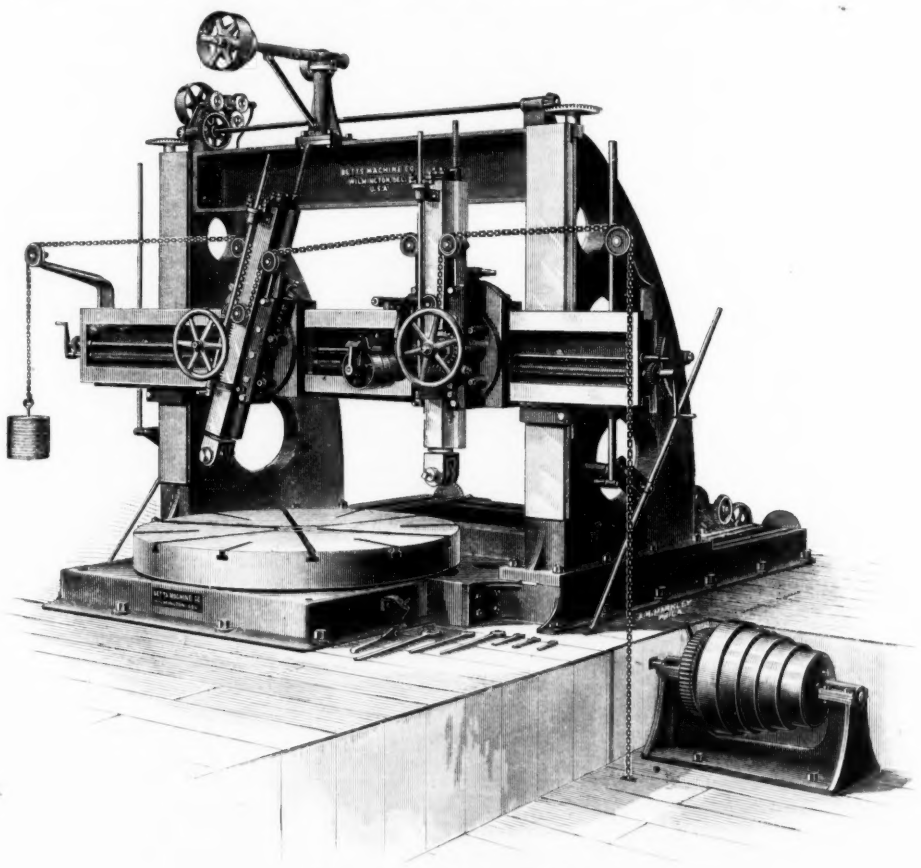
The cut shows a slotting attachment on one saddle, which is used chiefly in cutting key-ways in large pulleys and fly-wheels, but of course can be applied to a number of other purposes. It has about as much power as a small planer, and a stroke equal to the travel of the cutter-bar, *i. e.*, 30 inches. It is driven from a countershaft attached to the cross-girt, and will slot either straight or taper, as desired. When disconnected it in no way interferes with the other uses of the saddle.

The housings are of the box form—made wide and with ample bearing upon the bed, and the cross-rail is secured to them by bolts, which pass entirely through the rail and the clamps, giving a rigid fastening.

The saddles and bars are entirely independent in their movements, either by hand or automatically, and the feeds vary from $\frac{1}{16}$ inch to $1\frac{1}{4}$ inches per revolution of table. The bars have a full bearing the entire length of the index plate, and have quick-return movements.

The table is provided with T slots to clamp work, and is supported either on a steel step at the bottom of its long spindle, for light work, or on an annular bearing of large surface for heavy work. When on heavy work the machine is generally driven through an internal spur gear in the outer rim of the table, and a pinion gearing thereto; this gives a very powerful and steady drive, with no tendency to lift the table; when running the table at fast speeds this pinion can be drawn out of gear and the table driven directly through its spindle; this removes the excessive wear always present when small pinions are driven very fast.

The gearing is of large face and heavy pitch, cut from the solid, and varies from $6\frac{6}{10}$ to 225 revolutions of cone to 1 of the table. The cross-rail is raised and lowered by power, and can be clamped at any point. The mill is very heavy and substantial, intended for heavy duty on all kinds of work, at the same time the builders have not neglected any feature which would increase the facility of handling or the output of the machine, but have endeavored to make the machine as convenient as possible.



BORING AND TURNING MILL.

The Baldwin Locomotive Works.

In our issue of October 24 we had something to say regarding the Baldwin Locomotive Works and their capacity, and afterwards received requests for further particulars.

In response to a request for these, addressed to the works, we received a statement from which we take the following facts:

Several new departments have been added to the shops of the company recently, among which are a new hammer shop, pattern storage-room, drop-hammer shop and wood shop.

Up to November 1 of this year 10,692 locomotives have been built, 737 of these during 1888. About 4,000 men are employed, and the works, with the necessary yards for storing and handling material, cover ten of Philadelphia's blocks.

During the month of October the works turned out 104 locomotives. These figures far exceed those of any other locomotive works in the world. In our former note regarding the works, we said that orders had been received by the heads of departments to get out locomotives at the rate of twenty-eight per week. It was not meant to say, however, that this rate would be or could be maintained indefinitely; but that it can be done for a short time even, is really one of the marvels of this age of manufacturing. The total production for this year is expected to be about 900 locomotives.

Velocity of Wind at the Top of Eiffel Tower.

In order to ascertain the wind velocity at the top of Eiffel Tower, an automatic anemometer constructed by Messrs. Richard Brothers, of Paris, was erected on the tower, at a height of 995 feet above the ground, another of these instruments was put up at a station 1,650 feet from the foot of the tower, and at a height of about 69 feet above the ground. From the observations obtained for 101 days, up to the 1st of October last, it appears that on an average the velocity of the wind was about 3.1 times as great at the lofty station, as at the lower one. The breeze at the top was always strong, its average velocity exceeded 25 feet per second, or 15.68 miles per hour; and during 21 per cent. of the whole period of the observation this average daily velocity was upwards of 33 feet per second, or 22.5 miles per hour. No great storm seems to have occurred during the time over which the observations extended.

Force, Motion and Work.

BY PEDRO.

EIGHTH PAPER—FORCE IN GENERAL.

Those who have followed us up to this point are now in possession of a sufficient amount of knowledge concerning the motion of matter to learn something about *force*, which is, in the natural order of things, the first part of our subject, but was left for discussion at this time for reasons already stated in the first paper. Force has always been surrounded with a great deal of mystery—it seems so, at least, to the young student, and often to the older ones. We will endeavor to remove some of the mysteries, as far as it lies in our power to do so, and to do this we feel it necessary to treat the subject in a different manner from that usually followed, but we trust that those interested will have no trouble in following the line of thought.

Thus far we have studied the laws of motion without regard to the nature of the cause or agent which produces it. The study of force relates to that cause, and in studying the origin of motion we are at once called upon to consider matter in connection with force.

The amount of matter (or "mass," as it is sometimes called,) that any body contains, is determined by its weight. For example, if a body weighs two pounds, we say that it contains two pounds of matter. If another body weighs ten pounds, it contains ten pounds of matter—five times as much as the first one—etc.

Most writers think that this is not an accurate way of determining the mass or amount of matter in a body, but it answers our purpose best, for the present at least.

Force, as usually defined in works on mechanics, is "that which produces or tends to produce motion or change of motion." In the same books we can read that *force is measured by the velocity which it generates in the unit of time*, or words to that effect. Here we are told, first, that force is the *cause* of motion, and then that force is a part of the motion itself—that it is an *effect* instead of a cause. This is very confusing to the beginner, and often a stumbling-block to the more advanced student.

To avoid such confusing contradictions, let us adopt the terms, *static force* and *dynamic force*. For the sake of brevity, we may use the term "force" by itself sometimes, in which case it should be understood that *static force* is meant. When *dynamic force* is spoken of, the modifying adjective should never be omitted.

Static force is that which causes material bodies to move, or to change their motion. In short, it is the *cause* of motion.

For example, if we *press* against the edge of a book lying on the table, it will move if *pressed* sufficiently hard. It is *pressure* (static force) that causes the cannon ball to leave the muzzle of the cannon and fly through space. It is the *pressure* (static force) against the sails of a vessel that propels it. The *steam pressure* (static force) on the piston of the steam engine drives our locomotives, mills, etc.

Static force is a general term, having reference to any exertion whatever. It is measured by the same standard as the weight of a body—in pounds. A force of ten pounds produces the same effect as a weight of ten pounds; hence, when we speak of static force, or of weight, we mean the same thing as far as quantity is concerned, the only difference being that *weight* is an effect produced by gravity, while the term static force is usually applied to the same effect produced by other causes. We get an idea of static force by lifting various objects of known weight.

Other terms are used in place of static force, which have special reference to the manner in which the force is applied, viz., pressure, strain, stress, tension, compression, pull, push, etc.

Strain is induced into the material of a substance by the outward application of force, and is that which tends to separate the particles, and when the strain becomes greater

than the cohesion of the particles the latter will be separated, as in the case of a rope breaking.

Stress usually refers to the pressure between two substances pressing against each other, as shearing stress is the pressure required in shearing metals and other substances—the pressure between the shear blade and the metal sheared.

Tension is a pull or a strain in the direction of the length of a substance, so that the tendency is to elongate or stretch it.

Compression refers to a pressure or strain applied in the opposite direction to that of tension, and the tendency is to shorten the substance in the direction of the force. A chord can be broken by tension (or tensile strain), but not by compression. A stone is crushed by compression, but cannot be crushed by tension.

It is not the object of these papers to go further than this in the analysis of static force. The investigation of the various physical agents which produce force belongs to the science of natural philosophy and physics. What we understand by force or pressure in every day's practice and experience is sufficient for our present purpose. The unit of static force or pressure that we shall adopt in these papers is the pound avoirdupois.

Now, what is *dynamic force?* Dynamic force, generally speaking, is the amount of matter moved over a given distance in one minute (the unit of time). The unit of dynamic force is *one pound of matter moved over a space of one foot in one minute*, and may be expressed as one *foot-pound-minute*. Static force is an elementary conception, requiring only one dimension to measure it. It may be represented by a straight line in the same manner as velocities. Dynamic force is a function, and is measured by the three elements or dimensions, weight, velocity and time. Static force is the cause of motion, while dynamic force is the result of motion. Static force may, and often does, exist without motion, but there is no such thing as dynamic force without motion.

To illustrate, let us refer to some diagrams to fix the distinction firmly in the mind. Fig. 24 is the geometrical representation of the unit of dynamic force. This represents a cube in which the side $A\ E$ represents the velocity (one foot) of the moving body. $A\ B$ is the time of motion (one minute), and $A\ D$ the weight of the body—one pound. Each one of these lines being laid off to the same scale, each one is a foot long, and therefore the dynamic force unit is represented by a volume of one cubic foot, and is expressed as one *foot-pound-minute*, because the foot, the pound and the minute are the three elements or dimensions which measure it.

If the velocity is anything else than one foot a minute, then the dynamic force contains as many units as there are units in the velocity. Fig. 25 represents a dynamic force of six foot-pound-minutes. The time of motion being one minute, and the weight one pound, it will take six of the blocks of Fig. 24 to make a row six feet long, which represents the velocity.

Again, if the weight of the body is more than one pound, the dynamic force is again increased as many times as there are pounds in the body moved. In Fig. 26 we have a dynamic force of 18 foot-pound-minutes, the number of blocks (units of dynamic force) in the pile being 18. Here the velocity, V, is six feet a minute and the weight moved ($A\ D$) is three pounds.

The same dynamic force is obtained with a body weighing six pounds and having a velocity of three feet a minute, as shown in Fig. 27.

In the sixth paper we have seen that motion is represented by a surface generated by a line $A\ E$, Figs. 24, 25, 26 and 27, equal to the velocity, passing over a distance $A\ B$, representing the time of motion, the velocity or motion of the body being the surface generated in one minute. In like manner dynamic force is represented by the volume generated by a plane, $A\ D\ F\ E$, whose length is equal to the velocity, and the height equal to the weight of the body, passing over a distance $A\ B$ represented by the time of motion, which is one minute. In this case the plane $A\ D\ F\ E$ is the generatrix, and $A\ B$, the time of motion, is the directrix used in generating the volume which represents the dynamic force.

If we represent the dynamic force by F, the weight of the body by w, and the velocity by V, then it is evident from the diagrams above, that 28..... $F = w\ V$.

That is, the number of blocks in the pile, or the number of dynamic force units in a moving body, is equal to the *product of the weight by the velocity*—the thickness of the pile (the time $A\ B$) being unity. We see, then, that the weight and the velocity may vary indefinitely, and the dynamic force still remain the same, as long as their product is the same. Two such variations are represented in Figs. 26 and 27, each being a dynamic force of 18 foot-pound-minutes, though the velocity and weight are different.

Since the dynamic force is always measured by the *unit of time*, and one minute being the unit we have adopted, we will henceforth use the simpler term *foot-pounds* (abbreviated, ft. lbs.) in place of foot-pound-minutes, the minute always being understood unless some other unit is mentioned, as foot-pound-seconds, foot-pound-hours, etc.

The reader may now see that there is a great difference between static and dynamic force. He should bear it distinctly in mind, then, that, when we speak of dynamic force, we do not mean static force. The term dynamic force should always suggest the idea of *weight and motion*, as has been fully explained. We have dwelt thus at length in explaining the difference between the two terms, because, in works on mechanics, the term "force" is so loosely and indiscriminately used in both the senses of static and dynamic force that it is perfectly bewildering to the novice.

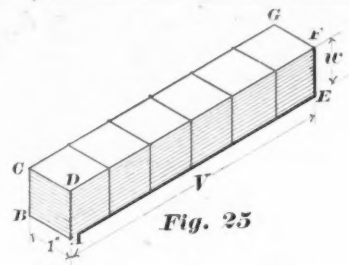


Fig. 25

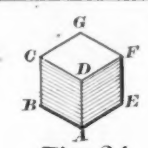


Fig. 24

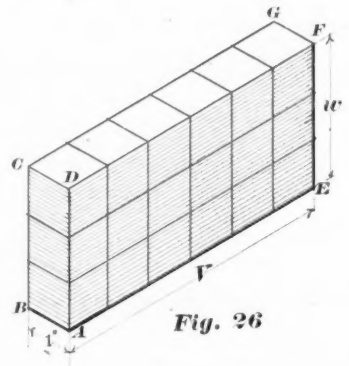


Fig. 26

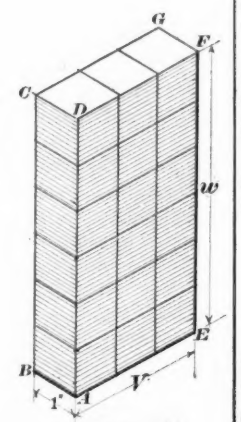
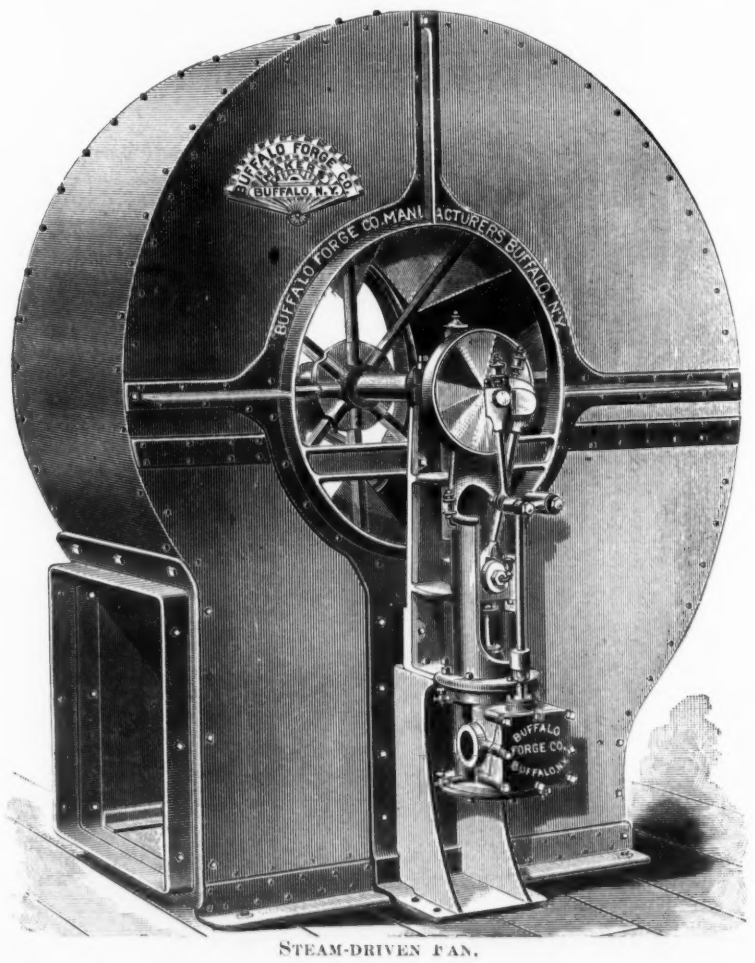


Fig. 27

FORCE, MOTION AND WORK.



STEAM-DRIVEN FAN.

It is sometimes urged that the lower Mississippi valley was settled some thousands of years too soon; that the annual overflow of the river would, in time, have raised the surface of the land, thus avoiding the damage now occasionally done by the giving way of the artificial banks. Electric lighting in this country seems to be on a parallel with this. The whole business has been rushed along, without the necessary precautions for safety, and apparently without much knowledge of what constituted safety. The result is that the inevitable trouble has come. It is sometimes better to make haste slowly.

Improved Steam-driven Fan.

The accompanying illustration shows a new design of direct attached engine just perfected and employed in connection with the Buffalo steam fans, the latest pattern of which also appears. There is no doubt that under many conditions, and especially in the case of large fans, the direct attached engine affords superior advantages in fan driving, especially where entirely noiseless action is imperatively required.

The engine is for either high or low pressure steam, and has balanced valves as well as all other improvements for reducing friction.

Incidentally, the engine acts as a brace, or support for the fan, the base being made of wrought steel.

Large bearings are provided on the engine, that for a 100-inch fan having a shaft 3¼ inches diameter, and with main bearings 15¼ inches long.

They are built in sizes ranging from 2 to 50 horse-power by the Buffalo Forge Co., Buffalo, N. Y.

Wrought-iron Pipe Flanges.

BY GEO. GUNTZ.

Pipe joints have always been the subject of talk, and sometimes pretty hard talk too. This trouble in pipe lines is not confined to collieries alone, although in mining, longer lines of steam pipe are employed than in most other instances. Lines of a thousand or fifteen hundred feet are very common, and two thousand feet not uncommon, or, as Mr. Davis remarked, they go underground through many narrow and crooked places, and to make a tight joint with the regular sleeve coupling is utterly out of the question. But the making of the joint in the steam pipe line about a mine is the part in erecting the line that is least neglected; as for instance, I have seen a pipe line suspended from the side or roof of a gangway, where the supports or hangers were over a hundred feet apart, and in nine hundred feet of pipe no attempt whatever was made to provide means to take up the expansion; and to add to this there was often a fluctuation in the steam pressure, ranging from 20 to 50 pounds.

Such things as these will make a steam pipe line "hump itself from way back," and not only destroy the threaded joint in the sleeve-coupling, but that in the ordinary flange as well, so that the necessity of a better joint has been a long-felt want, that many attempts have been made to fill.

Following are illustrations of three different efforts in this direction.

In Fig. 1, page 3, the inside corner of the flange was cut off at an angle of 45°, and the pipe screwed through the hub, until it came flush, or nearly so, with the face of the flange, and the triangular space thus formed was filled with a lead gasket, large enough so that, when a joint started to leak, the screwing up of the bolts would press the gasket into the threaded joint between the hub and the pipe and make it tight, and at the same time make the face joint tight as well.

In Fig. 2, an ordinary pipe flange has cast into the end of the hub an annular groove, into which a lead ring was caulked to make the screw joint tight, while the face joint was made tight with the packing.

Fig. 3 is something on the order of the joint shown by Mr. Davis, only instead of having lugs on the face of the flange, to act as a guide to the opposite face, this is made male and female, bored, and turned to an easy fit, and faced off flush with the end of the pipe, and the gasket made to fit in the female flange.

Fig. 1 is a pretty fair device, and will do pretty good service.

Fig. 2 is no better than the ordinary flange, but Fig. 3 can be depended on, under any fair conditions, as it makes no difference how much the joint works, the packing cannot be blown out so long as the bolts hold the joint together, which is not the case with the other two, or that shown by Mr. Davis.

On Fulton street, New York, there is an electric railway—that is, there is a track purporting to be for the purpose of electric car propulsion. That track has been in position for two years, more or less. But no electrically-propelled cars have passed over it, and no one that we know of believes that such cars ever will pass over it. Great holes occasionally appear in its anatomy, holes that endanger the legs of truck horses. Such things as this are likely to reduce confidence in the future of electric tramways.

Practical Drawing.

By J. G. A. MEYER.

LAST PAPER.

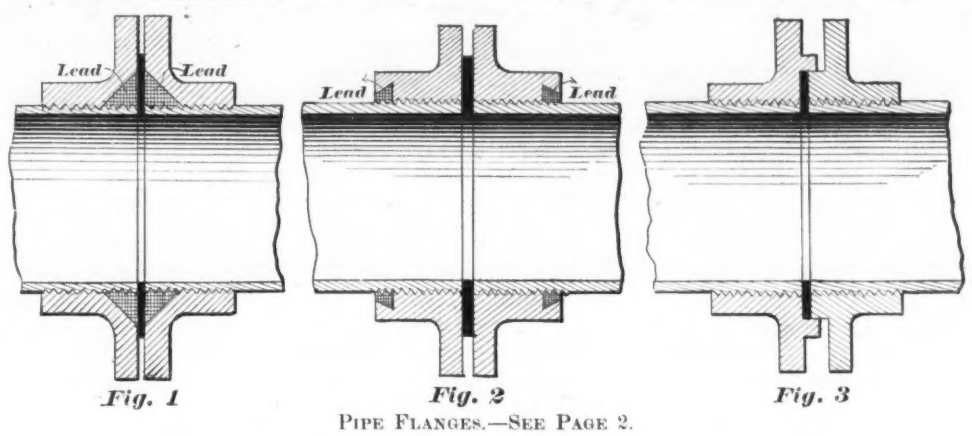


Fig. 1 *Fig. 2* *Fig. 3*

PIPE FLANGES.—SEE PAGE 2.

Problem 112.

661. *To find the section made by a plane passed through a cone.*

Let $v\ a\ b$ (Fig. 528*a*) be the vertical projection of a cone, and let $e_1\ e_7$ be the given cutting plane; it is required to find the section.

Divide the line $e_1\ e_7$ into any number of equal parts, say six. Through the points e_1, e_7, and also through the points of division e_2, e_3, etc., draw horizontal lines, cutting the element $v\ b$ in the points f_1, f_2, f_3, etc. Assume that these horizontal lines represent auxiliary cutting planes, the section made by each one of these planes will be a circle as represented by the circles drawn in broken lines (Fig. 528); the circle $a_2\ b_2\ c_2\ d_2$ is the horizontal projection of the base of the cone. The diameters of the other circles in Fig. 528 are quickly found by drawing through the points f_1, f_2, f_3, etc., vertical lines, cutting the horizontal diameter a_2, b_2 in the points 1, 2, 3, etc., and describing from the center of the base, circles whose circumferences pass through the points 1, 2, 3, etc. The point g_1, in which the circle through point 1 cuts the diameter $a_2\ b_2$, is one point in the curve in which the plane $e_1\ e_7$ cuts the convex surface of the cone; the point g_7, in which the vertical through e_7 cuts the diameter $a_2\ b_2$, is another point in the required curve. Through the point e_2 draw a vertical line cutting the circle through 2 in the points i_2, g_2; again, through the point e_3 draw a vertical line cutting the circle through 3 in the points i_3, g_3; in a similar way we find the points i_4, g_4, i_5, g_5, i_6 and g_6. Join all these points by a curve. This curve is the intersection of the convex surface of the cone with the given cutting plane, and forms the boundary line of the shaded portion which is the horizontal projection of the required section.

In Fig. 528, the distance between the points g_1, g_7 does not show the correct length of the section, because the latter is shown foreshortened. The true form of the section is found in the following manner: Through the points e_1, e_2, e_3, etc., draw lines perpendicular to $e_1\ e_7$, and at any convenient distance from $e_1\ e_7$, draw parallel to it the line $j_1\ j_7$, cutting the perpendiculars, previously drawn, in the points j_1 j_2, j_3, etc.; make $j_2\ l_2$ (Fig. 528*b*) te qual o$h_2\ g_2$ (Fig. 528); $j_3\ l_3$ equal to $h_3\ g_3$, and so on. Again because $h_2\ i_2$ (Fig. 528) is equal to $h_2\ g_2$; $h_3\ i_3$ equal to $h_3\ g_3$, etc.; the line $j_2\ k_2$ (Fig. 528*b*) must be equal to $j_2\ l_2$; $j_3\ k_3$ equal to $j_3\ l_3$ and so on. Join the points j_1, l_2 l_3 . . . j_7, k_6, k_5, etc., by a curve, and thus complete the outline of the shaded surface in Fig. 528*b*, which is the true form of the section; it is an ellipse.

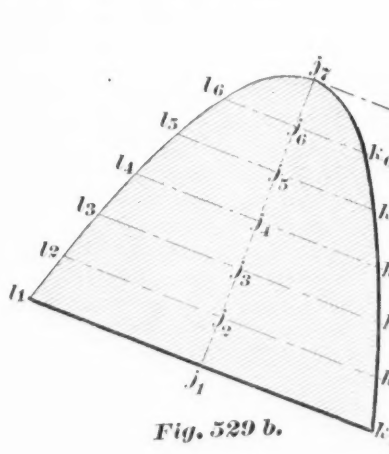


Fig. 529 b.

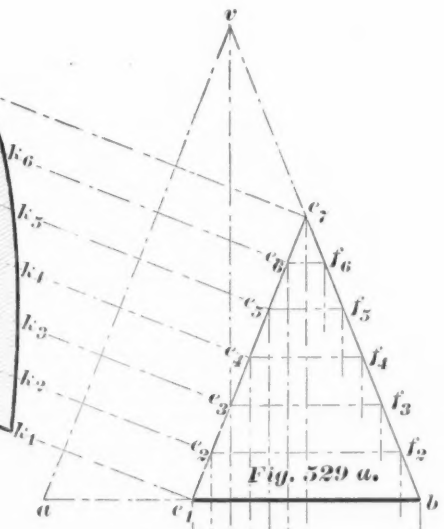
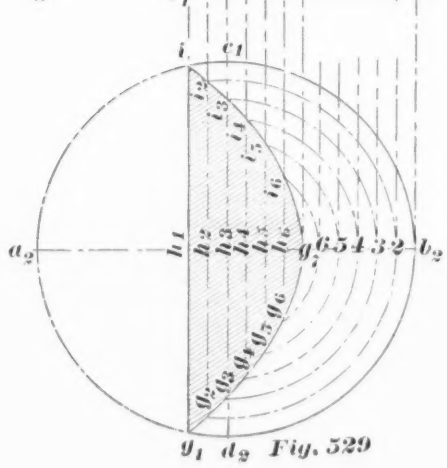


Fig. 529 a.



g_1 d_2 *Fig. 529*

662. *To find the section made by a plane passed through a cone; the plane being parallel to an element.*

Let $v\ a\ b$ (Fig. 529*a*) be the vertical projection of a cone; and $e_1\ e_7$, the cutting plane parallel to the element $v\ a$; it is required to find the section.

Divide the line $e_1\ e_7$ into any number of equal parts, say six, and through the points of division e_2, e_3, etc., draw horizontal lines cutting $v\ b$ in the points f_2, f_3, etc.; through these points draw vertical lines cutting the horizontal diameter $a_2\ b_2$ (Fig. 529) in the points 2, 3, etc. From the center of the base draw arcs passing through the points 2, 3, 4, etc. Through the point e, draw a vertical line, cutting the circle $a_2\ b_2\ c_2\ d_2$ in the points g_1 and i; these will be points in the curve of intersection. Through the points e_2, e_3, e_4, etc., draw vertical lines, the vertical through e_2 cutting the arc 2 in the points g_2, i_2; the vertical through e_3 cutting the arc 3 in the points g_3, i_3, and so on. Join the points g_1, g_2, g_3 . . . i_3, i by a curve which will be intersection of the convex surface, and the given plane. The shaded surface bounded by the curve $i\ g_6\ g_1$, and the straight line $i\ g_1$, in Fig. 529, is the horizontal projection of the required section; but because it is shown foreshortened, we do not see its true length.

Through the points e_1, e_2, e_3, etc., draw lines perpendicular to $e_1\ e_7$; at any convenient distance from this line, and parallel to it, draw the line $j_1\ j_7$, cutting the perpendiculars in the points j_1, j_2, j_3, etc. Make $j_1\ l_1$ equal to $h_1\ g_1$; $j_2\ l_2$ equal to $h_2\ g_2$; and so on. Since $h_1\ i$ is equal to $h_1\ g_1$, it follows that $j_1\ k_1$ will be equal to $j_1\ l_1$; similar remarks apply to the other auxiliary lines. Join the points l_1, l_2 . . . k_2, k by a curve; the shaded surface bounded by this curve, and the straight line $l_1\ k_1$, is the true form of the section; it is a parabola.

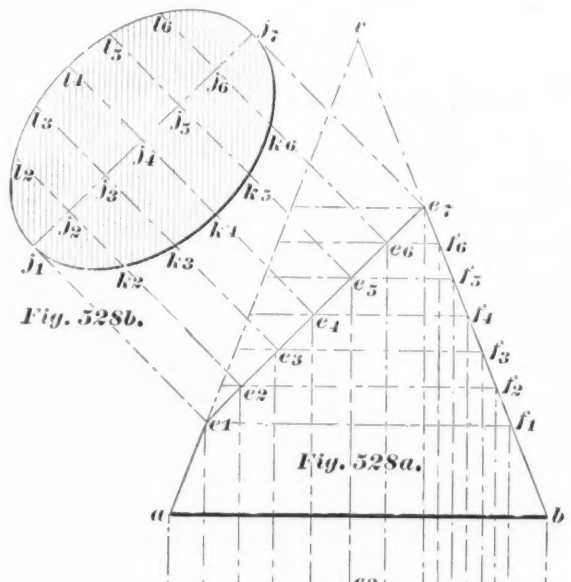


Fig. 528a.

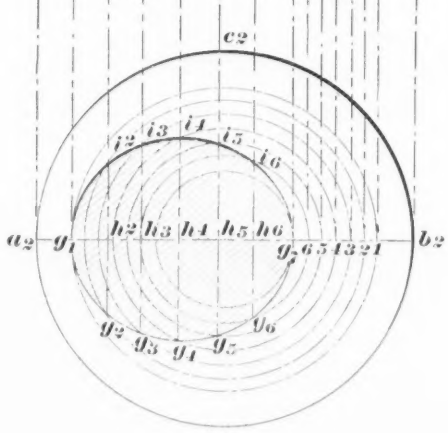


Fig. 528.

PRACTICAL DRAWING.

Problem 114.

663. *To find the section made by a plane passed through a cone; the plane being parallel to the axis of the cone.*

Let $v\ a\ b$ (Fig. 530*a*) be the vertical projection of the cone; $e_1\ e_6$, the given cutting plane; it is required to find the section.

Divide the line $e_1\ e_6$ into any number of equal parts, say five, and through the points of division e_2, e_3, etc., draw horizontal lines cutting the element $v\ b$ in the points f_2, f_3, etc. Through these points draw vertical lines cutting the horizontal diameter $a_2\ b_2$ in the points 2, 3, etc. From the center c_2 describe arcs passing the points 2, 3, and so on, cutting the line $g_1\ i_1$ in the points g_2, g_3, i_2, i_3, etc. At any convenient distance from $e_1\ e_7$ and parallel to it, draw the line $j_1\ j_6$ (Fig. 530*b*), prolong the horizontal lines $e_2\ f_2$, $e_3\ f_3$, cutting the line $j_1\ j_6$ in the points j_2, j_3, etc. Make $l_1\ j_1$ equal to $g_1\ i_6$; $j_2\ l_2$ equal to $g_2\ i_6$, and so on; lay off the same distances on the other side of $j_1\ j_6$ and thus obtain the points k_1, k_2, k_3, etc. Join the points l_1, l_2 . . . k_2, k_1, and thus complete the outline of the shaded surface in Fig. 530*b*, which is called the hyperbola.

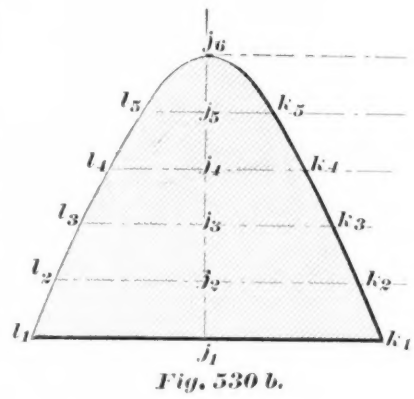


Fig. 530 b.

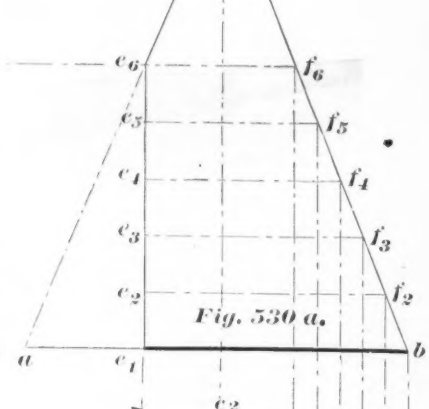


Fig. 530 a.

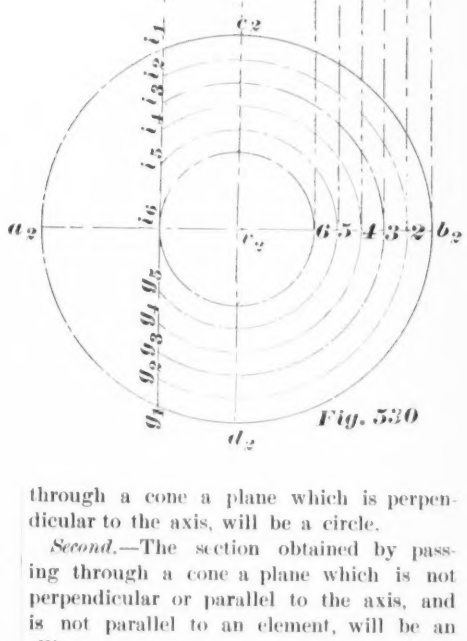


Fig. 530

664. From the foregoing we learn:

First.—The section obtained by passing through a cone a plane which is perpendicular to the axis, will be a circle.

Second.—The section obtained by passing through a cone a plane which is not perpendicular or parallel to the axis, and is not parallel to an element, will be an ellipse.

Third.—The section obtained by passing through the cone a plane which is parallel to an element, will be the parabola.

Fourth.—The section obtained by passing through the cone a plane which is parallel to the axis, will be the hyperbola.

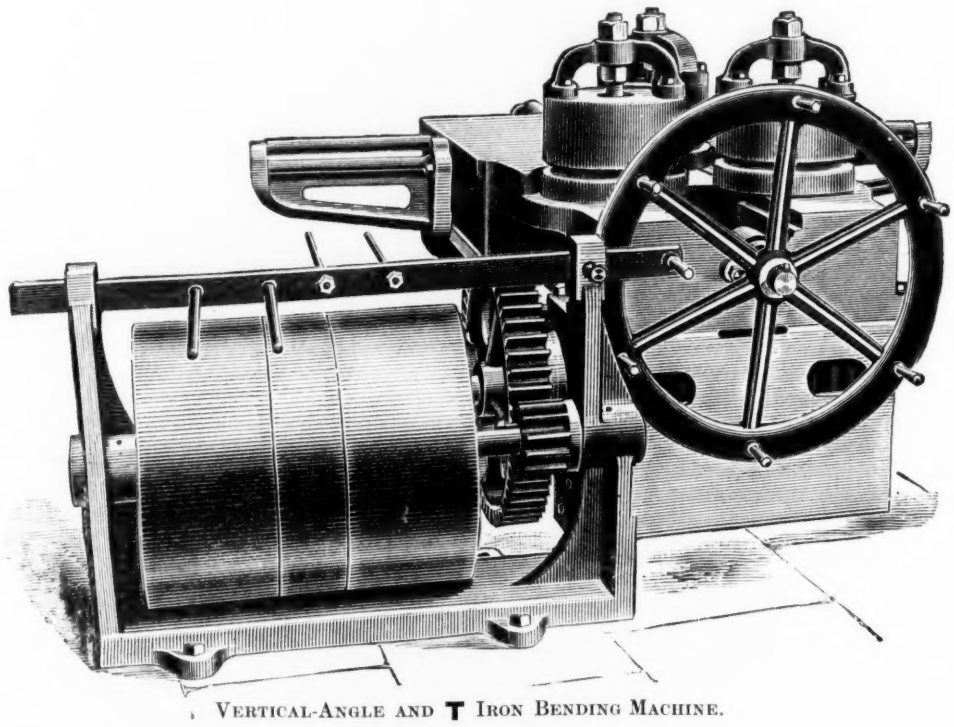
The foregoing articles, with many additional problems, and their application to every day practice, will be published in book form.

Subways in New York City.

From the present aspect of things, it is reasonable to assume that the close of the year of 1889 will usher out to a great extent the dangers resulting from overhead wires in New York City. It is also reasonable to assume from past experiences that the year of 1890 will usher in an era of subway explosions. The last is not conducive to pleasant reflections for pedestrians, or women and children on a shopping tour. It will be advantageous to the officials who control these subways to indulge in a little reflection also, and engage the services of the ablest engineers, before the subways meet the same fate as that of the overhead wires.

Improved Machinery for Structural Iron and Steel Work.

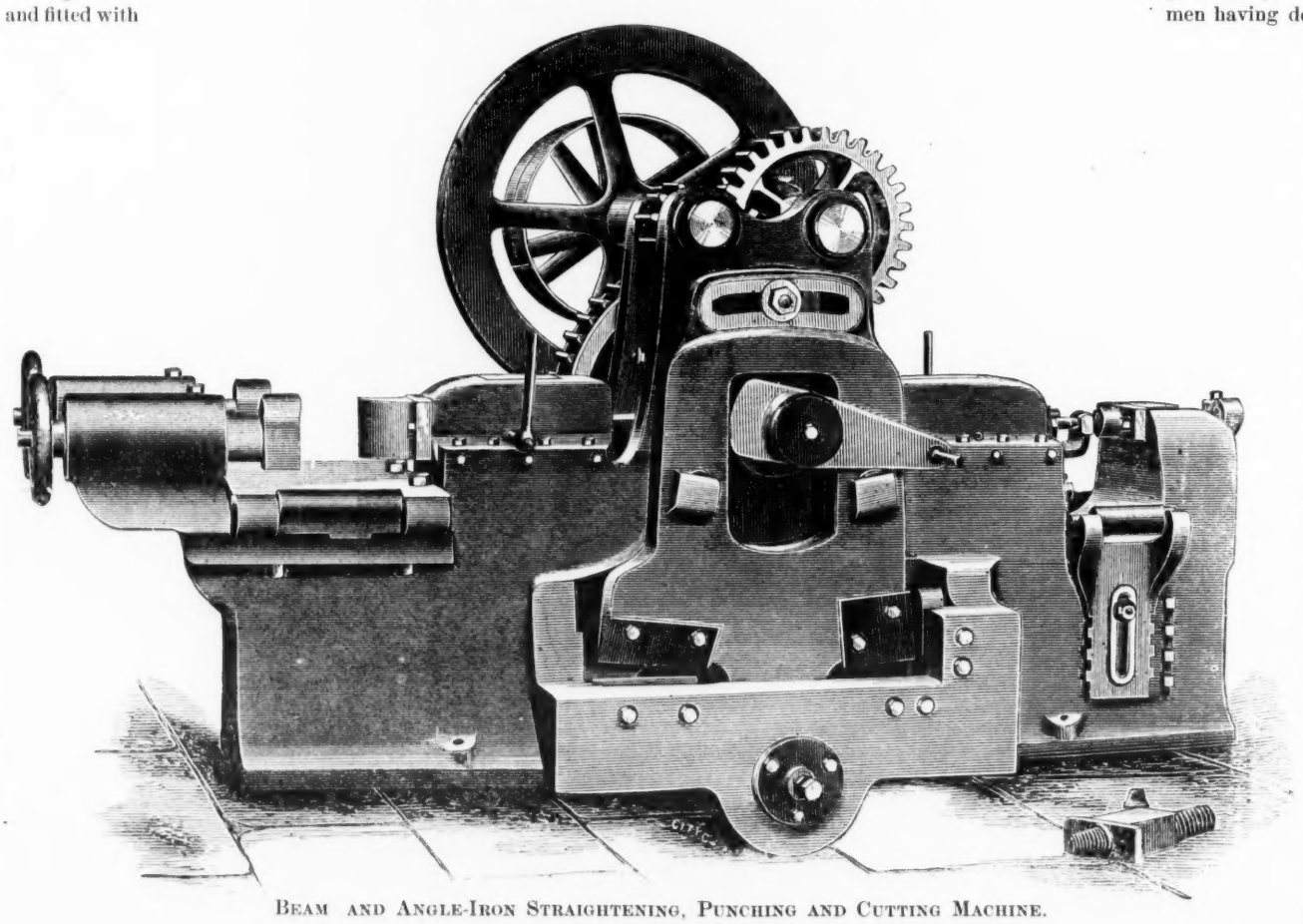
With this we give illustrations of some recently designed English machinery for use primarily in shipyards or where other structural iron or steel work is done. The first of these is designed for bending angle-iron 6 x 6, T iron and flat bars. The rollers project above the table, which is planed for the angle-iron to rest on whilst going through the rolls when bending small diameters. The iron is also supported by the brackets with rollers, when bending large diameters, as shown in the illustration. Each roller is in two parts, the bottom part of roller going, say, 2″ below top of planed part of table, and projects, say, ⅛″ above on top side, so that no friction is caused through the angle-iron being pressed against the table. The top part of the rolls can be raised or lowered by a screw which passes through the bridges on the top of the rolls, to suit the different thicknesses of angle-iron to be bent. This secures a great saving of time as compared with rolls which have to be lifted off, and washers put in between for different thicknesses. The machine is very powerfully geared with spur and worm gear, having a ratio of 90 to 1. The table is made strong enough to be used as a leveling block when required, and the brackets can be moved in the T slots endways or readily taken off, so as to leave the table clear. Small rings can be rapidly bent by this machine. The worm shaft bearings are bushed with brass to take the strain.



VERTICAL-ANGLE AND T IRON BENDING MACHINE.

The second illustration is of a machine which will bend deck or bulb beams up to 12 inches deep at one end of machine, with friction rollers and adjustable rams of wrought-iron worked by hand-wheels, and fitted with stop-motion to slide, etc. The other end of the machine is arranged to punch one-inch holes in one-inch plates, 12″ from edge, the center of punch-die being close to edge, so as to punch angle-iron when required; this end is also arranged for riveting angle-iron or deck beams, the punch die being taken out, and adjustable cupping dies put in, as shown on floor in illustration. It can also be arranged for punching channel-iron. This end of machine is also arranged with stop-motion. In front of machine, angle-iron of any length, 6″ x 6″, can be cut, and flat bars 8″ x 1″, or angle-iron in both places; this slide is also arranged with stop-motion.

The builders are Rushworth & Co., Sowerby Bridge, Yorkshire, England.



BEAM AND ANGLE-IRON STRAIGHTENING, PUNCHING AND CUTTING MACHINE.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

THIRTY-NINTH PAPER.

To return to what was done in the city shops under the resolution granting *Shawk* their use—Jeffery Seymore, I think, was at the time head of the fire department, and had charge of the shops. I know he did all in his power to forward Shawk. An old fire engine, known as the Rowboat, in consequence of the manner man-power was applied, was being dismantled; its double acting horizontal cylinder was just the thing Mr. Shawk wanted, and it was utilized, as was also the running gear of the old engine, its wooden wheels and axles; this engine was built by Farnsworth, whose shops adjoined those of the city, and he aided in the demonstrative experiment; on a platform on the axles of the old engine was placed the *Buchanan coil* in a sheet-iron furnace—also the horizontal pump cylinder with its air vessel, etc.; a steam cylinder or small steam engine to work it, was required; this Mr. Shawk found at Latta's shop, and it was loaned to Shawk by Mr. A. B. Latta for the purpose of the experiment.

The simple loan of this engine was the proved so eminently successful; it cannot be said simply introducing, for it was a hard road to travel.

To proceed with the story. When the patched-up affair was completed at the city shops, a successful private trial was made; then by invitation, a more public one; to this I went in company of Father Collins and Miles Greenwood. We found quite a crowd of prominent citizens, all the members of the committee of the fire department, and most of the members of the council, and other city authorities. Fuel, which of course was in the best possible condition for rapid ignition, was placed in the fire-box, in and under the coil, and those present requested to time from the application of the torch to the fuel. Soon many watches were in hand, and, as might be expected, great discrepancy in the result reported, some going as low as 3 minutes, but it was conceded by all that 150 feet of hose was filled, and a steady stream of water thrown from a branch pipe at its end, within five minutes of the ignition. Great satisfaction was expressed by all present, and Mr. Shawk was greatly elated.

It was proposed, in case of fire, this crude engine should be put in service, and preparations were made accordingly, but it was found that the weight was too great for the light running gear of the old Rowboat; the wooden axles had sprung, and it was evident that, if run, a break-down would be inevitable; by blocking up, other trials equally successful were made. Mr. Shawk was jubilant at his success, and, aided by advocates he found among those who had witnessed the trial, pressed on council to make an appropriation to have an efficient engine constructed, which he—Mr. Shawk—offered to do, and to guarantee its satisfactory performance, for the sum of ($5,000) five thousand dollars. After a long delay, and a hard fight with the obstructionist party, the committee of fire department were authorized to contract with *Abel Shawk*, on the basis of his proposition. Before commencing the work, a shop that could do the job, must be found, a door-lock making shop, had neither room, tools, or facilities for that kind of work. At this stage it was natural that Mr. Shawk should look to Latta, who had loaned him the steam engine for the trial, and whose mechanical experience in locomotive building he thought would be invaluable; this resulted in a copartnership being formed, under the name of Shawk & Latta, and to that firm the order was given. In confirmation of my recollection of this fact, I am indebted to the kindness of Gen. Sargent for abstracts from the minutes of council and the committee of the fire department, in all of which reference is made to the firm of Shawk & Latta.

Mr. Latta, being a practical mechanic and steam engineer, had the making of the drawings and designs for its construction. In this stage of the work I had almost daily intercourse with either one or both of the parties, and was frequently appealed to on questions of difference of opinion. To me, an outsider, it was evident that a partnership in an enterprise of two men having decided views and opinions, not in perfect harmony, and both rather obstinate in maintaining them, was not the best possible association to reach an early, harmonious and successful issue. As to their different views in relation to this first engine, my recollection is very clear. Mr. Shawk's often expressed idea was an engine of the simplest possible form that a *coil steam generator*, steam cylinder and pump could be put into; nothing extraneous to add weight, the utmost lightness compatible with strength and durability, the weight to be kept within the range of man or horse-power for easy handling and rapid transit. He was opposed to using a water space fire-box with large steam space, on account of additional weight; he urged that his inspirator was all-sufficient in maintaining supply of water, vitilizing the steam, as he expressed it, and giving steam space. This inspirator was a small upright cylinder boiler, placed beside the coil. It was attached to the coil and into it the evolved steam from the coil passed, and from it, as a steam dome, steam was taken to drive the engine. As to whether this belonged to the original Buchanan coil, or was an addition of Mr. Shawk's, I do not know; but I recollect that, when speaking of it, he always said, "*my inspirator*." Mr. Latta's experience with locomotives had taught him the value of a water space around a fire-box for steadiness in generating steam and utilizing furnace

extent of Mr. Latta's connection with what demonstrated the value of the *coil generator*, and the feasibility of steam as the motor for fire engine pumps. In many recent notices that have been extensively copied and spread broadcast over the country, the entire credit for the first practical steam fire engine has been given to Mr. Latta—a credit that, if he were now living, I feel confident he would not claim for himself; there must be many persons still living, cognizant of the main facts as I have stated them. I would not in the least detract from the well-earned credit due to Mr. Latta for his ingenuity displayed at a later period, his untiring perseverance in forcing into use a system that has

heat that would be lost without it. Mr. Latta argued that, in building the engine for the city, it was incumbent on them to make it as perfect as possible, that no appliance tending to that end regardless of added weight should be omitted. He considered that of but little importance, as he contemplated making the engine a traction engine, and self-moving. Mr. Shawk strenuously objected to this, urging, as the principal objection, loss of time in getting up steam; for, even should that not exceed four or five minutes, it might prove disastrous. Mr. Latta claimed that speed in transit would in most cases more than make up for this loss. It was with great reluctance that Mr. Shawk gave way on these points. For lightness combined with strength, considerable ingenuity was displayed in lattice frames, skeleton wheels, etc. But I do not think any detailed estimates of the weight of the various parts, had ever been made, for Mr. Latta said that, including the attachments for the traction, he expected to keep the weight below six tons. Neither could there have been any estimate of cost, for the proposition of Mr. Shawk, to build for the city an efficient steam fire engine for the sum of ($5,000) five thousand dollars, was made immediately after the experimental trial, and before plans had been digested, further than to determine that, for steam generators, the *Buchanan coil* for a steam cylinder or engine and double-acting horizontal pump for the fire engine, were to be used. The demonstrative experiment had been an inexpensive one to Shawk, being mainly his outlay of time; for it was like the old woman's pie that cost nothing, all the ingredients being in the house.

In mounting the coil generator, and putting together the parts found in the city shops, and the steam engine loaned by Latta, he gave valuable aid. The city fire engineer so considered such assistance of labor at his command, that he could give a part of the privilege of free use of shops and materials. Mr. Farnsworth gave assistance by his workmen, when required. The trial looked forward to was so important that all around lent a willing hand. On Mr. Shawk's idea of a simply constructed steam fire engine, based on the result of the working of the model patchwork, he felt himself abundantly safe in his offer to build and deliver to the city an efficient engine, for the sum of five thousand dollars. It proved that in this he was greatly mistaken; for, as is too often the case with new inventions, not thoroughly digested, as the work progressed changes and additions were made, increasing the cost, and Messrs. Shawk & Latta discovered that, by the time the machine would be ready for delivery to the city, it would be at a cost to them, of nearly, if not quite double what the city was to pay them for it. As the work advanced, payments had been made. From the abstracts of the minutes of the council, furnished me by Gen. Sargent, I find that on the 27th of October, 1852, an ordinance was offered to appropriate ($500) five hundred dollars on account of the steam fire engine, being the remainder of the $5,000—four thousand five hundred ($4,500) having been paid. This was referred to a special committee, who reported Oct. 29th, the substance of which report was: That they found the steam fire engine nearly completed, that there had been expended on it for materials and labor more than the five thousand dollars claimed by the council as the contract price, and that to fully complete the engine ready for practical use would be at a cost to the builders of about five thousand dollars in addition to the five thousand. That Shawk & Latta did not consider themselves bound to complete and deliver it for the five thousand, but, by the aid of an additional five thousand (5,000) they will complete it and exhibit it, so that its merits may be understood and tried, and they expect to claim from council, if the machine is satisfactory, all it has or will cost. They also reserve to their own discretion and choice whether they will ask further appropriation from council, even if the machine should prove a failure practically. As to the success of the experiment, the builders seem to entertain no doubt; as to that we do not propose to advise council, although we see no reason to doubt that the expectations of those who previously tested the model engine will be realized now. We recommend that the five hundred dollars, being the balance unpaid of the (5,000) five thousand, be now appropriated to Messrs. *Shawk & Latta*, and that all other matters be reserved for future decision, as experience may require.

The recommendation of the committee to appropriate the five hundred dollars was amended, requiring Shawk & Latta to give the city a mortgage on the engine at its completion, to secure the city in the amount of $5,000. This was further amended by saying, council will abide by the original understanding if Shawk & Latta accept the $500 as balance of the five thousand. A further amendment: That the subject matter be referred back to the committee to examine the accounts of Shawk & Latta, in the expenditure of the four thousand five hundred, already advanced by the city on the contract: the second amendment, that the city abide by the original understanding, and Shawk & Latta agreeing that the five hundred is balance due on the five thousand the city is to pay for the machine, passed.

On the 17th of November, council again resolved the same as on Oct. 29th, insisting on the five thousand being the price to be paid to Shawk & Latta for the machine.

When asked for my recollections as to the true paternity and progress to the successful demonstration of the Cincinnati fire engine, coupled with published notices giving the entire credit to Mr. A. B. Latta, Shawk's name never being referred to, it seemed strange that out of the many citizens of Cincinnati, who must have been conversant with the facts, no one had essayed to correct the error, and give to Mr. Abel Shawk the true portion of the credit due him. As I have before stated, I felt a delicacy in doing so, without some cotemporary or documentary evidence of the correctness of my recollection; being well aware that when, on the down grade, a man has passed his eightieth year, he cannot rely implicitly on his own memory, let alone giving to the world its fruits as facts. By going to Cincinnati, I thought I would have no difficulty in confirming or confuting. To show my errror, I will give an instance or two of my want of early success, also, in tracing a first conception through its various stages to its ultimation.

The first person I called on was an old and intimate friend, some two or three years my senior, who I knew in early life to have been an active fireman, and still a member of the "Rovers," one of the independent companies I have referred to at the time the steam fire engine was built, and who I recollected as having been present at the trial of Shawk's model or experimental engine with his original Buchanan steam generator, and also one of the most interested spectators at the trials of the engine built for the city by *Shawk & Latta*. His recollection was clear as to the disbandment of the Independents and the surrender or donation of their apparatus to the city, but he could not give even approximate dates; but in the course of conversation he recalled several incidents that occurred on the first trial of the engine built for the city and its *failure as a traction engine*, and the abandonment of that feature. He recollected that Shawk was not disappointed, but seemed rather pleased, as he had always been opposed to it, on the ground of loss of time in getting up steam, that should be done on the way to the fire. I called his attention to published articles giving the entire credit of the first engine to Latta; he had read them, and, strange as it appears, in reading them, in his mind he had substituted Shawk for Latta, without the most distant idea that, to persons unacquainted with the facts, Shawk was being entirely ignored. He said that both Shawk and Latta were so associated in his mind, and his recollection of the first great efforts of the former, that he was uppermost when any reference was made to either the firm or the engine. He asked me if I had heard of the death of my old neighbor, Uncle Joe Ross; for, he added, if he were living he could give all the information you want, for, had it not been for him as member of the council and chairman of the committee of the fire department, Shawk could never have had from the city the use of their shops, nor aid to make his first experiments, nor the after contract for the engine named after Uncle Joe Ross, in remembrance of his services. This statement rather staggered and surprised me, and made me doubt my own memory, for I had an impression that both Shawk and Latta looked upon Mr. Ross as their greatest opponent in council, and mover of amendments that caused delays and trouble. My friend spoke of a party still living, who at the time was one of the youngest members of the "Rovers." On seeing him, his only knowledge was confined to the trials of the engine and its final acceptance by the city, but in referring to the name of the engine—Uncle Joe Ross—he repeated what my friend had said, and added to it, "It was not only what Ross did for them in the council, but by his financial aid they were enabled to build the engine named after him." He then referred me to Gen. C. H Sargent, who, he believed, was at the time chairman of the committee of fire department, and he knew had always taken a great interest in everything pertaining to the success of the steam fire engine, and the organization of the pay fire department.

I found him not only clear in his knowledge of the details of the entire fire department, but in his recollection of efforts made by Mr. Shawk to have the test of the coil generator made for steam fire engines, and to his kindness I am indebted for some details that I had not recalled, and also for the abstracts from the minutes of the council I have referred to. When I named to him the reason that had been given to me for naming the first engine "Uncle Joe Ross," he laughed, saying it was a capital satire or lampoon; that every one knew Ross in the role of economic reformer, ever watchful of city expenditures, so much so that he had gained the name of the "Great Obstructionist" on any motion for improvements requiring outlay; that no one who had ever heard his impressive and almost terrific "I object," could ever forget it. When the trial of the first engine was exhibited there was no name on it. When playing two streams through long sections of hose, some one in the crowd of spectators exclaimed in the hearing of Mr. Shaw, "She is a snorter—she is like Uncle Joe Ross"; at the next public trial that name was on the engine.

LETTERS FROM PRACTICAL MEN.

Boiler Management.

Editor American Machinist:

While it requires considerable skill to keep a tubular boiler clean using water containing carbonate and sulphate of lime, it certainly requires no less skill to keep a water-tube boiler in proper condition. While the latter may at first sight seem the easier scaled, yet on practical trial it does not appear so. To a large extent the keeping in order depends on the engineer.

You may easily find steam users who unreservedly condemn water tube boilers, while in the next square, using the same water, may be found those who declare as freely that the water tubes are the best. Generally, this difference of results lies in the failure or success of the engineer in keeping the boiler free from scale. The best results are from the men who keep the boilers up to the highest standard.

A first-class live steam purifier is, in almost every case, a complete assurance of freedom from scaling, with all the advantages and benefits that the absence of scale may give. Many a steam plant could be highly benefited by this useful scale remover, and thus avoid a great amount of Sunday work for the engineer.

I have endeavored to get acquainted with all the modes of cleaning water-tube boilers practiced by different engineers. Many hold to the old fashion of blowing out at say 15 pounds pressure, standing a few hours with doors and dampers open, and then scraping the tubes and washing out. It is evident that any good in removing scale by this method is accomplished by difference in contraction between the iron and scale, the former being acted upon by the cold blast of air rapidly cooling while the scale is very hot, say from 212° to 240° Fahr. One can easily foresee the result—the scale being more or less detached from the iron; but what must be the effect of such treatment on the iron? Only a person ignorant of how to care for a boiler, or the effects of sudden contractions, would subject a boiler to this mode of loosening the scale at the expense of the repair bill of the boiler. Many engineers avoid this, allowing their boiler to cool slowly, the water being left in until all ready to clean, when it is dropped out, manheads opened, caps removed, and the tubes scraped or bored out. Having tried both plans I have, I think, a better one to offer. Allow the ash-pit doors and damper to remain open Saturday night, and then on Sunday morning, when ready to clean, drop the water down so that it will not run out the upper horizontal row of tubes when the caps are removed. Then proceed to *bore out in the hot water*, dropping the water as row after row is scraped, until all the long tubes are done, when the water is allowed to entirely escape. The rear vertical tubes may be scraped first, while the manheads on the upper should be removed at the first drop. I have seen two men work ten hours cleaning a boiler after being blown out under a pressure of ten pounds, eight hours being taken up in boring the tubes, and I have seen two men under this method bore the tubes in one hour, and do a better job, the other conditions being equal. It is probably true that the hot water acts to render the scale softer and more detachable, and it may be that the water going through the porous scale is between it and the iron. If this should be true of a boiler under hot water it would be true under steam, and may account for the fact that there is not, in practice, that loss of heat from heavy scale that has been presumed. However this theory may be, the value of this method is twofold—ease of removing scale and equal cooling of the exterior and interior of the boiler.

Regarding the use of compounds in connection with cleaning, I believe that, whichever method may be used, it pays to put in a fair amount, say thirty-six hours before cleaning.

Regarding the cleaning of the cap and seat, I have found that waste, well saturated with coal oil, quickens the works by loosening any sediment that may adhere to the seats, followed, of course, by a skillful use of a hand-scraper, working so that the scraper follows all around the circle of the seat, as one would face up in a lathe.

But, after all, there comes the work of making say 99 steam-tight joints, with the fact that a failure in one shuts you down. The upper drum manheads are best packed with rubber, well coated with plumbago and oil. I have found lead gaskets a cheap and durable joint for the mud drum plate. Some engineers use varnish for the caps, but please excuse me from cleaning them, especially while there is any plumbago in the land. A stiff mixture of plumbago and cylinder oil, applied with a brush, has always made the joint, preserved the surfaces, and is easily cleaned. After washing out, scrape the seats, wipe off clean, then paint all with the plumbago, and beginning at the top run down two headers, putting on the caps, tighten with the wrench, and proceed as before. The nuts should be run off the bolts to allow the water in the hole to escape, this being done when cap is cleaned.

There is a point, in pulling with a wrench, where further pulling is wrong, and I can say this must be learned for oneself. Through an experience extending over fifteen years I have little by little learned about where I should stop pulling. I say about, for I am still learning. When you pull up a cap on a boiler just stop at this point, though you will have to find it for yourself. When filling your boiler, watch for leaks, and, should a cap leak, drop the water, take off the cap, clean again and put on. Often in slipping in the frog a minute bit of scale will fall, catch on the plumbago and show a leak. Should the boiler be tight with cold water it's safe for a good job. Never, no never,

put a wrench on a cap-nut while pressure is up.

I saw a clever escape from shutting down the boiler. The engineer, after cleaning his boiler, and while filling up, found one of the short nipples at the back end connecting the mud drum and header was leaking badly. He had plenty of 4" pipe, but no expander nor long taper pin, so he could not put in a new one. It was suggested to slip a band clamp on, but there was nothing suitable at hand. So he went to the wood-shop, got a piece of pine and trued it up in the lathe to fit inside the tube, and then bored a 2" hole through it, took off the cap and forced it down into the nipple. The water swelled the wood and made a tight job until convenient to put in a new nipple, some three months later. DUPLEX.

Automatic Wire Straightener and Cutter.

The illustration represents a machine which takes wire from the coil, straightens it perfectly and cuts it in pieces of any desired length.

The straightener shaft has four bevel dies, set alternately in opposite directions, tightened or loosened by four screws, and is operated by a belt from a parallel shaft underneath, which carries six-inch tight and loose pulleys, balance-wheel and a clutch tension sleeve with two cams attached; one throws the cutter and the other opens the guide-bar or tube for the piece of wire, which has been cut off, to fall out.

The engraving shows a machine having a guide-bar for three-foot lengths or under, but they are built for longer lengths when desired. No countershaft is required, but the machine is run by one three-inch belt from the main shaft, which may be either above or below the machine.

The wire is never scratched in the machine and an unusually large range of sizes can be handled.

The machine is built by the Collins-Goodin Mfg. Co., St. Louis, Mo.

Condition and Prospect of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

The Frick Company (Eclipse Machinery, Corliss Steam Engines, Ice Making and Refrigerating Machines, Steam Boilers, etc.), Waynesboro, Franklin Co., Pa., write us:

We have to report that we have been forced, during the past year, to add largely to our facilities, and contemplate, in order to accommodate our rapidly increasing business, further additions. We have been doing all that we possibly could do, and the prospects for the coming year point to a similar condition of affairs.

One remarkable feature of the business at the present time is the overwhelming number of substantial inquiries for very heavy machinery, which augers well for this line of business. Competition is very severe, prices ruling lower than is best for the producer or consumer. The cost of production in our case is materially reduced by increased facilities. Materials that enter into the construction of boilers, pipe work, etc., have been advanced in price. From our knowledge of the market, we look forward to the coming year for specially satisfactory results.

S. W. Card & Co. (Taps, Dies, etc.), Mansfield, Mass., write us:

We are glad to be able to say that our business during the year 1889 has been steadily increasing, and the prospect for 1890 is very encouraging.

The D. Frisbie Company (Passenger and Freight Elevators, Clutch Pulleys, Hoisting Engines, Hoisting Machinery, etc.), New Haven, Conn. and New York, write us:

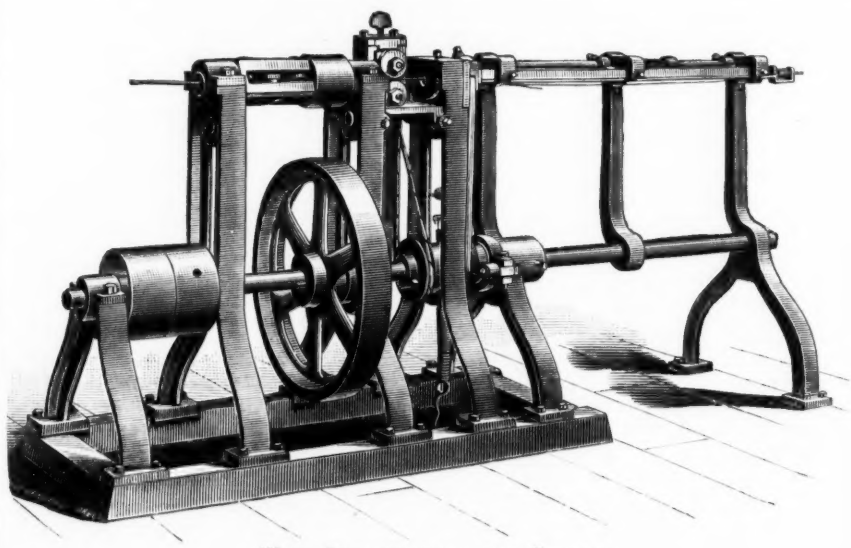
We have to say that our business has been very good the past year; our friction pulleys are being used more and more by large electric light plants, and we have made some very large and powerful ones the past year; our elevator department is booming, and we are very busy furnishing a first-class elevator at very low prices; we also have made and put with our elevators several electric motors, and they are so well liked that this style of running elevators is becoming very popular. We have had a very severe blow in the loss of our late president, Mr. Dennis Frisbie, who died August 1st after a brief illness of only ten days. Other than this we feel we cannot complain, and the prospects for 1890 are very flattering. We have one of our 60-light dynamos in our factory, and are well lighted, and can now run nights with the same pleasure as by day, for if there is anything that hinders and bothers night work, it is poor light.

S. M. York (Machinery & Engineering), Cleveland, O., writes us:

We are pleased to announce that our business for the past year has shown a marked improvement over previous years, and in the last six months has increased fully 50 per cent. over the corresponding months of last year. We consider the outlook for 1890 extremely favorable. In our manufacturing department, known as The American Tool Works, we are also very busy, having orders for some time ahead for our specialties, which, as they become better known, are much sought after.

Jenkins & Lingle (Engineers and Machinists), Bellefonte, Pa., write us:

There have been no material changes in the price of skilled labor in this vicinity during the current year. We have made no enlargement of our works, but our capacity is and has been taxed to the utmost almost continuously day and night. Our business being principally rolling mill work, mining machinery, etc., especially that class of machinery designed for washing and separating coal (for coking), iron ore, and manganese orders



WIRE STRAIGHTENER AND CUTTER.

now entered will keep us busy for several months. The outlook generally in this State is very encouraging. Ninety promises to be a busy year with fair prices.

R. M. Clough (Gear Cutters and Small Tools), Meriden, Conn., writes us:

I commenced the manufacturing of the Patent Duplex Gear Cutter about a year ago. I have sold quite a good many pair of them. They are liked first-rate, especially in jobbing shops and shops where a great variety of gear cuting is done. I do considerable gear cutting myself, and use no other cutter. They cut any gear above 15 teeth, and make a good strong tooth, and save shifting cutters for different sizes of gears. I do a variety of work besides gear cutting, such as punch and die work, mould making, electric work, etc. Find business first-rate, and lastly will say I think it pays to advertise in the AMERICAN MACHINIST as well as in any paper I know of.

The Hoggson & Pettis Mfg. Co. (Chucks, Bank Punch, Type Writers, Belt Clamps, Dies, Stencil Stamps and Special Machinery), New Haven, Conn., write us:

The year 1888 was an excellent one for us, having done a larger amount than ever before. We are glad to be able to state that this year's business will show an increase over last, and that the amount done in our chuck department in '89 we have increased about 60 per cent. over last year, which speaks volumes for the popularity of "The Sweetland Chuck." The outlook for '90 is very bright.

The Harrisburg Car Manufacturing Co.—Foundry and Machine Department (Steam Engines, Road Rollers, Boilers, Saw Mills, Grain Separators, etc.), write us:

The year 1889 has been a very busy season for the foundry and machine department. The manufactures for the past year have exceeded previous years nearly 50 per cent.

The output consisted of automatic, simple and compound engines, steam road rollers, boilers, oil tanks, gas apparatus and several large contracts for the Spreckles sugar refinery in Philadelphia, requiring over a thousand (1,000) tons of iron.

Our export trade has for the past year been considerable, to Canada, Mexico, and principally to Cuba, from which sources we have recently filled large orders for engines and boilers.

We have, at the present time, orders on our books for five (5) large engines for Cuba sugar plantations. Also contracts for Spreckles sugar refinery for spring delivery.

We are at the present time equipping several large electric railway plants with engines and boilers.

Our present orders for simple and compound engines will occupy our establishment for the next three months, to its fullest capacity. The prospects for the coming year are very favorable, and promise to be equal to our facilities.

The Ferracute Machine Company (Presses, Dies and other Sheet Metal Tools), Bridgeton, New Jersey, write us:

We have had a steady trade during the year, and for a few months were greatly rushed, so that we had to run considerable overtime. Our orders for standard presses, dies and other sheet metal tools are steadily increasing, especially among the hardware factories, railroad shops, electrical apparatus manufacturers, etc. We have introduced a number of new machines, and have improved our old ones, paying special attention to presses for forming heavy sheet metals into various shapes, which were formerly made of cast or malleable iron. We have added two new buildings, and increased our machines and tools considerably, and are now building a ten-ton electric traveling crane for our erecting shop. We have reorganized our working forces, and are in better shape than ever before, for manufacturing economically on the duplicate system. Our foreign trade is increasing, and we anticipate during the coming year a considerably larger volume of sales.

I. P. Richards (Punches and Dies), Providence, R. I., writes us:

The punch business has been good the last year, especially in my "*new*" standard punches, which are gaining in favor wherever used, and orders for them are gradually increasing.

This must be owing to their economy, convenience, and to advertising in the AMERICAN MACHINIST, which is the best paper in the world for our business.

The Fitchburg Machine Works (Manufacturers of Metal Working Machinery), Fitchburg, Mass., write us:

In reply to your favor of the 17th, beg to say that all of our new machines have now been illustrated, some of them in your paper; we made a sale of a machine in Glasgow, as a result of its being illustrated in your paper of Aug. 8th; we shall take pleasure in sending you anything new that we have.

The Hilles & Jones Company (Machine Tools), Wilmington, Delaware, write us:

In regard to our business of the past year, we would say, that during nearly the whole of the time we have been full of work on our specialties of heavy tools for working plate iron and shape iron—such as punches, shears of all styles, plate planers, rolls, milling machines, etc. We are now building an erecting shop 70 ft. wide, one story high, 28 ft. in the square, with a twenty-ton traveling crane, which will enable us to handle our heavy machinery much more advantageously. Our prospects seem good for the coming year, and we are constantly receiving orders. Our established reputation as builders of good machinery, is a great aid to us in obtaining orders, and we have a great many warm friends among users of our tools.

Sterling Elliott (Bicycles, Quadricycles, Express Cycles, Drill Presses, Tap-Drill Gauges, Cutting-off Machines, Stitching and Tying Machines), Newton, Mass., writes us:

Replying to yours 10th inst., it gives us much pleasure (why shouldn't it?) to report that our business which doubled last year, has increased fourfold this year.

With the addition now building, we shall have 14,000 square feet of floor.

This increase makes us, for the present, a little short of steam, though, if we build a new motor of which we have been thinking, there will be no lack of power. It is to be run by the falling due (of interest); the question now is, whether we can make it fall on the right side.

Pancoast & Maule (Pipe Fittings and Pipe Cutting, and Threading Machinery), Philadelphia, Pa., write us:

Our general business is very satisfactory, with excellent prospects in the near future. Prices of raw material are advancing, which, as usual, stimulates trade, apart from the prosperity now so universal all over the country.

The T. C. Dill Machine Co. (Disconnecting Device for Valve Rods for Steam Engines, Key-Seating Machine, Stub Ends, etc.), Philadelphia, Pa., write us:

We wish to say that in regards to the progress of our business for the present year, we have very much for which to be thankful, and for 1890 good cause to be hopeful. Our business has been steadily increasing, and with the increase of business, we have increased our facilities to such an extent, as to enable us to quote much lower prices.

We are now manufacturing patent, portable, key-seating machines, our improved hook for steam engines and stub ends for small connections. We also furnish the rod complete with adjustment, especially adapted for valve rods for Corliss steam engines, at a very low cost.

The Aerated Fuel Company, Springfield, Mass., write us:

In reply to your letter of Dec. 10th, would say that the past year has been an unusually busy one for us. Our sales have exceeded anything we had anticipated. We have been expecting that November, December, January and February, would be dull months for us as in preceding years, but must admit that large orders are continually coming in, and our entire force are at work constructing plants where our fuel is used, and the orders on our books will keep us busy until the middle of February, if we should not receive another order until that time. We account for this in two ways; first, that business is on the increase and in a very healthy condition; secondly, people are beginning to appreciate the value of our device for burning crude petroleum.

The Mason Regulator Co. (Steam Regulating Specialties), Boston, Mass., write us:

The great difference between the present and the year before seems to be in the fact that this year's business shows a steadiness, which was wanting in 1888. In that year orders would suddenly flood us, obliging us to work nights. Last spring we moved into our new factory, and since that time we have steadily increased the number of men employed, to keep pace with increase of business. Our shipments of goods, other than those used in the railroad line, have shown a decided increase over last year, while the car-heating companies still continue the use of our reducing valves for that purpose. The sale of several hundred of our air-brake governors for use on the Westinghouse air-brake pump, has been a feature of this year's business, and several of the leading railroads of the country are now equipping with them. Regarding the coming year we can say that we shall make an especial point of selling our new steam damper regulator, on which patents have just been awarded. We shall also place on the market several new steam regulating specialties. Of course we cannot predict the future, but, if construction facilities, quality of goods, and the art of letting people know what you have to sell, will dispose of our products, we intend to do an increased business in the future.

Williams, White & Co. (Forming and Forging Machines, Drop Hammers, Punch and

Shears, Spring-Power Hammers, Special Machinery, Eye Bolt Machines, etc.), Moline, Ill., write us:

We felt all summer that trade was dull, but on taking account of stock the first of November, which is the end of our fiscal year, we found that we had done about the usual amount of business, and had had a very satisfactory year.

Since that trade has picked up very perceptibly. Have sold out all that we had in stock and are now behind orders for our special tools. The outlook is all that could be desired. Hope that no boom will be inaugurated, and the depression sure to follow come in as a result. Neither a flood nor a drouth is our prayer.

Howard White (White's Patent Flexible Metallic Fillet, for Pattern Makers and Architects), Philadelphia, Pa., writes us:

My sales of flexible metallic fillet for the use of pattern makers, during 1889, have, in amount, far exceeded that of any previous year.

The Westcott Chuck Company (Chucks), Oneida, N. Y., write us:

The business of 1889 has been satisfactory. The demand for our chucks has grown steadily through the year, and even with our increased plant and working force we have been obliged to work most of the year on extra time. We find a generally sanguine feeling among home and foreign traders, and confidently expect a good sale for our manufactures for 1890. Our chucks steadily increase in favor with machinists everywhere.

The L. W. Pond Machine Company (Iron Planers), Worcester, Mass., write us:

The amount of the year's business has been very satisfactory, considering that we moved into new quarters, and were, of course, somewhat delayed by that.

We have added a number of new tools, and sold our second-hand planers, substituting for them those of our own make with all our latest improvements.

We have largely increased facilities in our new shop, running the largest force of men that we ever have since organized, and considerable of the time until ten o'clock in the evening.

We have a large number of orders on our books, are constantly adding to them, and are unable to quote, at this time, definite dates for future deliveries.

We have made numerous changes in our planers, looking to their improvement, both in design and durability, and feel that our efforts to make the best tools to be had, and devoting our attention exclusively to planers, is being appreciated by the public.

The outlook for 1890 seems to us to be very encouraging.

The Curtis Regulator Co. (Engineering Specialties), Boston, Mass., write us:

The volume of our business has been such for the past year as to tax our increased facilities to the utmost. We have kept a full complement of hands all summer, and still have been able to accumulate but little stock to meet our fall trade. We are bringing out some new specialties this fall, among which are a simple and absolutely perfect thermostatic clamper regulator for hot water boilers, and a valve and thermostat for controlling the temperature in steam cars, halls, banks, offices, etc., for which we find a great demand. We have recently furnished a 12-inch steam pressure regulator, to the Planet Mills, Brooklyn, N. Y.

Curtis & Curtis (Die Stocks, Pipe Cutting and Threading Machinery, Ratchet Drills, Steam and Gas Fitters' Hand Tools, etc.), Bridgeport, Conn., write us:

We would say that within the last year our output has increased about fifty per cent. on last year's business. This has made necessary a very large increase in our machinery, and we contemplate adding a large addition to our works in the spring. Our works are crowded to the utmost, and we are running overtime with all the men we can accommodate. The advance in iron and steel has made the profit small, as we have thus far not advanced our prices, but we prefer, if possible, to have a large out-put at a small profit, rather than a small out-put at a large profit. We consider our success largely due to the great improvements that we have made in our machines, and to the general increase of business throughout the country. We could have done a still larger business if we had been able to make quick delivery on some special sizes of large power-pipe machines, and we anticipate still larger business for next year.

B. W. Payne & Sons (Manufacturers of Vertical and Horizontal, Automatic and Corliss Engines, Vertical and Stationary Steel Boilers, Condensing and Non-Condensing Compound Engines), Elmira, N. Y., write us:

We would say that the amount of our sales during the past year has been larger than for 1888. The prospects for the coming season are good and we anticipate a large increase.

The Worcester Machine Screw Co. (Set, Cap and Machine Screws), Worcester, Mass., write us:

We have had a good business all the year, having had all we could do, in every branch of our works. The out-look for 1890 we consider very flattering, and look for a good business all the year. There has been no change in the prices of our goods during the year. There has recently been quite an advance in the price of the material used in our goods, and we also find that the laborers want more pay. We have not enlarged our works to any extent the past year.

Randolph Brandt (Selden Patent Packing, Mine, Mill and Steamship Supplies), New York, writes us:

Having in '88 largely increased my facilities for the manufacture of the "Selden Packings," and handling of general supplies, the business of '89 has been done more satisfactorily, and orders filled promptly. The increase of trade though, I regret to say, has not demanded any important additions to plant during this year. My experience during the past twelve months has been that buyers have distributed their orders through the seasons, so that while single invoices may not have been so large, the account for the year foots up an equal or larger total. It is pleasing to report a larger export trade than anticipated.

Why '90 should not prove to be a year which will make us all "turn to" early and "quit" late I fail to see.

The Garvin Machine Co. (Machine Tools), New York City, writes us:

Since you last heard from us less than a year ago, we have been compelled to take more commodious quarters. We have succeeded in getting our plant arranged to suit us, and have more than doubled our capacity. We have added many new and improved tools to our already large plant until now we believe we are equipped for most any work in our line.

We have had a very prosperous year's business, and the outlook for next year is equally as flattering.

L. S. Starrett (Fine Mechanical Tools), Athol, Mass., writes us:

I am pleased to say that 1889 shows a larger increase in my sales than any previous year, and I have found it necessary to provide more room for my factory. This I have done by adding two stories, 75x40 feet, making it now five stories high. For some reasons should have preferred enlarging on the ground, had the room for so doing been available. Yet as it is I get better light, while with a good elevator connecting each floor there are several advantages in having them as they are. I am, from time to time, adding such new tools to my productions as seem to be called for, and am now and then putting in improved machinery best adapted to do the work.

My patented improvements in small tools have taken with so much favor among mechanics as to stir the ambition of competitors to get out of the ruts and to drive along on my tracks as closely as they dare, while some have dared to drive closer than may prove safe for infringers to do.

The present outlook for a continued increased demand for my tools never looked better, and I never felt more determined to keep in the lead by means of honest merit than now.

The Lackawanna Lubricating Co. (Cylinder Lubricators, Grease Cups, etc.,) Scranton, Pa., write us:

The introduction of a new article, especially among engineers and users of machinery generally, is always a somewhat slow and uphill job. Our case is no exception to the rule, and, in fact, we might say that the past year has been devoted principally to placing our grease cups, as much as possible, where they would be of great benefit to us as advertisements.

We have no reason, however, to complain of the amount of business done, and now that our goods are becoming so widely and favorably known all over the country, we consider the outlook for the future as very good, and expect the coming year to bring us in a large increase in our business.

We have gained very valuable experience during the year, and are better prepared than ever to supply the wants of our customers promptly and guarantee them entire satisfaction.

Edward O. Chase (Light and Fine Machinery, Foot Lathes, Slide Rests and Lathe Fittings, Machinery and Dies for Hard Rubber Work), Newark, N. J., writes us:

It seems to me that my prediction of a year ago has been verified, at least so far as my own business is concerned, that is, the year now closing has been a more busy and profitable one than the last.

We have had all we could do, and in the main it has been good and profitable work, which was *paid for*, and the proportion of bad or doubtful accounts, which any one in the line of specialties and jobbing work has always to guard against, has been smaller than usual, and business generally has been conducted on a careful and conservative basis.

This may be largely due to the fact that with more work offered than we could attend to, we have done only such as we preferred to do, and turned away much that, in other times, we would have gladly handled. Prices and wages remain about the same as in 1888, and it seems to me that the outlook for the coming year is encouraging, if the "order book," on which we base our calculations, is any indication.

The American Watch Tool Co., Waltham, Mass., write us:

We have no special particulars relating to the progress of our business in 1889, or prospects for '90. The volume of last year's business has been larger than any previous year, and we anticipate a slight increase for '90, but there has been a slight advance in materials and wages, and slight reductions in the prices of our output, while the increased volume of output, with various economies in general expenses, has left us with about as much income as the previous three years.

The Vance Tube Cutter Co., Geneva, N. Y., write us:

Replying to your esteemed favor of the 10th inst., we beg to state that our business has been very flattering indeed for the past year. We have placed our flue cutters in the shops of the leading railroads of the country, and find that they give entire satisfaction. The introduction of our cutters into the repair shops of boiler makers was somewhat slow, until we brought out our own combination tool, but as that meets the want in that direction, we find the orders for it are increasing on our books each day.

We are also anticipating a large sale of our cutters the coming year, in the English market. We find no competition against us in the field, as we have the only tool for removing old flues from locomotive and stationary boilers that is known to the trade, and the fact of our being able to make a cut that reduces the size of the flue so that it may be removed through the same hole in the flue sheet is of considerable importance in this work, and is appreciated by boiler makers in general.

The Billings & Spencer Co. (Machinists' Tools and Drop Forgings), Hartford, Conn., write us:

We are pleased to report that we consider the prospects for a good business year in 1890 are very encouraging, and we expect to make even larger sales than during the present year, which has quite equaled our expectations.

We have made important extensions to our plant in the way of new buildings and new machinery, and are at present increasing our steam plant by the addition of a new 100 H. P. boiler.

We are doing a large and increasing business in our Billings patent commutator bars for dynamos and motors, and are supplying the principal manufacturers of these machines with them. The demand for these goods has so increased that we expect to use about 200 tons of copper in their manufacture during the coming year.

The demand for our goods in the way of drop forgings for wrenches, eye-bolts, etc., has been very flattering, as has also the demand for finished goods.

We shall place some new goods on the market early in the year, among them a new line of 15 degree angle end wrenches, and a line of machinists' hammers, which we expect will "take" with the trade.

Prices of material have advanced somewhat, but we shall keep our product at present prices as long as possible. On the whole the results of the year 1889 have been very satisfactory, and the prospects for 1890 are decidedly encouraging.

The Athol Machine Co. (Iron Founders and Manufacturers of Hardware Specialties, Meat Cutters, Vises, etc.), Athol, Mass., write us:

Our sales are larger than last year, but no more so perhaps than that of others in our line. The coming year will, we think, be a prosperous one.

The Standard Tool Co. (Fine Tools), Athol, Mass., write us:

Business with us the past year has been very satisfactory, sales good, collections prompt, and at the present time orders are above the average for the season. We have a number of new tools that we expect to have ready for spring trade, including a micrometer caliper, caliper gauge, and caliper rule, that we consider improvements on anything now on the market, and for which we feel sure there will be a large demand.

The Buffalo Steam Pump Co., Buffalo, N. Y., write us:

The past season has been one of unusual prosperity for us, and at the present time we have more orders on our books than ever before. Under the circumstances we feel encouraged as to the future of our business. Our representatives all report bright prospects for the coming season.

The Buffalo Forge Co. (Forges, Blowers, Exhausters, Punches, Shears and Drilling Machines, Patent Steam Hot Blast Heaters, Ventilating Wheels and Engines), Buffalo, N. Y., write us:

The volume of our business done in 1889, as compared with that of 1888, has far exceeded our most sanguine expectations. Nothing could be more indicative of its healthy growth than the fact that we have materially increased the capacity of our buildings by building two stories higher, which one year ago adequately met all demands for space, and the addition of a new plant with the introduction of new and improved machinery to the several departments. The fame of the Buffalo forges, blowers, blacksmith drills, etc., can by no means be confined to America, as frequent orders from a number of the foreign countries show, these being far in excess of any previous year. With many improved patterns of the several lines of our manufacture having been recently perfected and put on the market, and with others of equal value to our customers now about ready, we feel prepared to fully satisfy the demand to which they may be subjected.

Our prediction of last year that the "Buffalo" hot blast apparatus, for heating and ventilating, was destined to become a leading branch of our business has become realized, far sooner than we were led to expect, we now having on hand sufficient orders in this department to keep us busy for a considerable time to come, and the warm reception which the apparatus has won on its merits wherever placed, dispels any question of its being perfectly efficient in every respect for use in large buildings.

Taking into consideration the current volume of inquiries in all of our lines, the outlook for 1890 from our point of view is most encouraging, and we predict fully as great a ratio of increase of orders for the coming year, as 1889 showed over 1888.

Gould & Eberhardt (Machine Tools), Newark, N. J., write us:

The volume of our business for 1889 has been much larger than any previous year, and has necessitated the addition of new machinery, which enables us to keep a force fully 25 per cent. larger than we employed one year ago.

The great demand for our automatic tools has led us to improve our methods of manufacture, so that we are now making some of them in lots of 24 at a time, and with the parts interchangeable to a large degree. We have been favored with many more foreign orders than ever before. We have declined a number of orders because we could not meet the prices tendered by others, without lowering the standard of work we have been doing. The outlook for the new year seems very bright, and we think there is reason to expect a continued and increasing prosperity for our country.

The E. Horton & Son Company (The Horton Lathe Chuck), Windsor Locks, Conn., write us:

Business with us is good, and has been all of the time for the past year. We have run a part of our works overtime for nearly a year. We have added some new tools, and new sizes and styles of chucks. Our list now comprises over three hundred styles and sizes of chucks. We are making eighteen sizes of improved independent chucks, running from 4" up to 38", the most complete list of this kind of chuck made by any one; we have also added to our list of car-wheel chucks. Prospects are good for business, we think, for the coming year, and we are well prepared for it, having a good stock of chucks on hand, and being well equipped with tools and machinery of the latest patterns and designs to build more with.

[A large number of letters stand over, to appear in a later issue.]

AMERICAN MACHINIST

ALL COMMUNICATIONS RELATING TO THIS PAPER SHOULD BE ADDRESSED:
AMERICAN MACHINIST,
96 FULTON ST., NEW YORK.

PUBLISHED WEEKLY AT
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

Subscription.

$2.50 a year in advance, postage prepaid in the United States, Canada, and Mexico.
$3.50 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY
The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

NEW YORK, JANUARY 2, 1890.

CONTENTS.

	PAGE.
10-16 Foot Boring and Turning Mill	1
The Baldwin Locomotive Works	1
Velocity of Wind at the Top of Eiffel Tower	1
Force, Motion and Work. By Pedro	1, 2
Improved Steam-driven Fan	2
Wrought-iron Pipe Flanges. By Geo. Guntz	2
Practical Drawing. By J. G. A. Meyer	3
Subways in New York City	3
Improved Machinery for Structural Iron and Steel Work	4
Early Engineering Reminiscences. By George Escol Sellers	4, 5
Letters from Practical Men: Boiler Management. By Duplex	5, 6
Automatic Wire Straightener and Cutter	6
Condition and Prospect of the Machinery Business	6, 7
The Machinery Trade	8
The Indicator on Locomotives	8
It Is Not Charity	8
Engineering History	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

The Machinery Trade.

With this, the first issue of the year 1890, we publish, in accordance with our usual custom, a large number of letters from the leading manufacturers of the country, giving conditions of trade during the past year, and prospects for the coming year. As we have always maintained, these letters, coming from men in the actual business of the day, are an excellent index of probable future business, and as such we call the attention of our readers to them. We are aware that the writers of these letters may look at the future through a rosy light, reflected from the experience of the past year, but it will be admitted that their judgment of the future is likely to be better than any at hand. It is the judgment of those who must forecast the future from year to year. The opinions of these men are, universally, to the effect that business during the year 1890 will be good. We have faith in these prognostications. There is not only the opinions of these men who keep their finger on the pulse of business, but there are plenty of other evidences that prosperity will reign during the coming year. Iron business generally is good, and nothing better than this indicates future trade prospects. Several iron companies have voluntarily increased the wages of their workmen, and good pay for workmen always means good business. Finished products—such as machine tools, steam engines and machinery in general—are selling too low. But these things will right themselves. There is every reason, now, to believe that the year 1890 will be a prosperous one, both for manufacturers and workmen. The AMERICAN MACHINIST wishes all a prosperous year.

The Indicator on Locomotives.

There is one point in connection with the use of the indicator on locomotives, which we are pursuaded is quite too frequently overlooked. It is too often forgotten that the boiler and the furnace are inseparable parts of a locomotive engine, and that, owing to this fact, it frequently happens, and indeed is usually the case, that what would be nearly the ideal indicator diagram for a stationary engine would indicate poor results for a locomotive having the same size cylinders and doing the same amount of work at the same initial pressure and speed.

The performance of a stationary engine in no way affects the economical performance of the boiler which supplies it with steam, and an indicator diagram from such an engine merely shows the performance of the engine only; indicating among other things the pressure at which steam is admitted to the cylinder, regardless of whether that pressure is economically or wastefully maintained in the boiler; the manner of using the steam in the cylinder having no effect whatever upon the economical combustion of fuel in the furnace.

With the locomotive the conditions are essentially different, because the exhaust is depended upon for the blast by which the fuel is burned and the steam kept up. It thus frequently happens that a diagram which would delight the eye of the indicator man, and which would represent to him the very acme of efficiency in that type of engine, would break the back of the locomotive fireman, and cause the engine to die on the road for the lack of steam. On the other hand, a diagram which, considered by itself, and solely with reference to the economical use of steam in the cylinder, would be considered a very poor one, might prove in practice to be the one giving the best economy by actual weighing of coal consumed. It may be said that for every cylinder of given dimensions, and having steam supplied to it at a given pressure, there is a certain distribution of steam which is the best one for that cylinder when doing the given amount of work. This distribution will be shown by an indicator diagram, which will represent the ideal conditions for that engine and for that work. But if the engine is a locomotive engine, the effect of the exhaust upon the fire must be taken into account, and there are many things about the boiler and fire-box, and in the front end, which may have an effect on the character of the exhaust required to give the best results. The kind of coal used, the form of the grate-bars, the size and number of flues, the diameter of exhaust nozzles, or the variation of an inch in the height of the petticoat pipe, may materially alter the character of the blast needed to produce the most efficient combustion of fuel; and, as this blast is furnished by the exhaust steam, the steam distribution and the indicator diagram representing the best possible performance will be correspondingly modified. This, of course, is no argument against the use of the indicator on locomotives, but should serve as a reminder that the indicator, like everything else, should be used only for the purpose for which it is adapted, and it certainly was never intended for the indication of boilers or fire-boxes. The use of the indicator has in the past been confined mainly to engines in which the exhaust has no direct effect on fuel consumption, and the theory of the indicator has been developed by such use of it. Those who propose to use it in locomotive practice must make the proper allowances for the different conditions, and failing to do so they should not blame the indicator, and declare it to be a humbug because they fail to get satisfactory results from it.

This is a matter too frequently ignored; it should always be remembered that the best indicator diagram from a locomotive is in the nature of a compromise between the cylinders and the boiler.

It Is Not Charity.

There are a good many large manufacturers in this country who set apart reading-rooms and libraries, and some of them establish gymnasiums and lecture-rooms, for the use of their workmen. We do not know of a single employer doing this who desires to pose as a philanthropist in the matter. It is an excellent thing to do, because, generally, both amusement and instruction can be had at less cost in this than in any other way, and, as a matter of business, it is pretty sure to pay the employer. It is only when it is paraded as an act of charity towards workmen that it becomes the reverse of beneficial. The American mechanic is not an object of charity. He will manage to get wages enough to support himself decently; or, failing in that, will live as best he can.

There is a good deal of silly gush about the pure business matter of a manufacturer making things as pleasant as he can for his workmen. It goes without saying that many of them take pleasure in doing so, and it is just as certain that it pays to do it. Such manufacturers may not be able to get along by paying less wages, but they are able to get, and to keep, a superior class of mechanics, who consider these outside advantages as part of what they work for. Mechanics who will make use of intellectual opportunities are sure to be more valuable as workmen than those who elect to remain ignorant, and they will stay where opportunities for intellectual improvement are plentiful.

There is gain both to the employer and to the workmen in this library and lecture-room plan. It is co-operation in the broadest sense of the word. The employer is sure to have superior workmen, and the men have access to facilities for improvement that they could hardly have otherwise. Some manufacturers have established libraries for their employes that no man of moderate means could ever hope to possess, and we do not believe they have lost a cent in doing so. One such man, who takes a great interest in the library, to which the firm is always adding, was asked by the writer what became of the apprentices that graduated from the shops. His reply was that many of them went away for a year or two, but that they were pretty certain to find their way back again.

There are many manufacturers who could not establish libraries on a large scale, but who could still make a beginning in a modest way, increasing a little year by year. We believe they would be more than repaid for all the efforts they made. But by all means divest the effort of even the semblance of charity.

Engineering History.

It is very interesting as well as valuable history which is being contributed to our columns by Mr. George Escol Sellers, and every mechanic will join with us in appreciation of the fact that so many of the occurrences connected with the early development of the steam fire engine are being placed on record in a form accessible to the public by one whose remarkable memory, habit of close observation, and of keeping memorandums, together with his unusual opportunities for meeting and becoming acquainted with the pioneer mechanical engineers of our country, make him peculiarly well qualified for the work he is doing.

The term "mechanical engineer" had not, it is true, been heard of at the time of which he writes, but the men whose ideas and accomplishments he records were nevertheless mechanical engineers of the highest order of ability, especially when we consider the difficulties they had to overcome, and the available means by which they had to overcome them.

And it is interesting to note the antiquity of some of the ideas which we are accustomed to regard as quite modern. It is but a few months ago that it was announced with considerable flourish that an inventor had devised a means of doing away with the steam boiler entirely, and that he proposed in its stead to have small tubes highly heated, into which just sufficient water was to be injected at each stroke of the engine to flash into steam for the next stroke, and that the engine was to be regulated by the amount of water injected at each stroke. Mr. Sellers shows us that this idea is nearly fifty years old, and was first thought of in connection with the steam fire engine, but for some reason—doubtless a good one—never put into practice.

Mr. Sellers is now considerably beyond the age at which most of us can hope to be of any use to our fellow-men, even if we live so long; but it is to be hoped that he will yet be able to record, for the benefit of our readers, many more of the interesting events connected with the early history of engineering in this country.

Questions and Answers

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither nam., correct initials nor location will be published.

(1) F. D. W., Brooklyn, Wis., writes: I want to make a cast-iron box, 8 inches by 10 inches inside, 6 feet long, to carry safely a steam pressure of 150 pounds per square inch. The box is to be nearly rectangular in cross-section. What is the best disposition of the metal in the sides of the box—plain, concave or convex? *A.*—We prefer to use plain sides, one inch thick.

(2) G. B., ———, asks: Is it desirable to use oil on a fluted chucking reamer when working cast-iron? *A.*—No law can be laid down for such things. If a mechanic gets results which suit him better by the use of oil than without it, then it is desirable for him to use it. It can be said, however, that oil is very little used in reaming cast-iron and that, in most cases, the reaming can be better done without it.

(3) S. R. Co., Buffalo, N. Y., writes: Please explain the meaning of the term "parts" as applied to recipes for mixtures of metals, viz.: 33 parts of copper, 25 parts of zinc, etc. Does it mean 33 ounces or $\frac{33}{100}$ parts of copper? The above has been discussed, and we would like to come to the same conclusion of its meaning. *A.*—Any unit of weight may be taken to measure the quantity of the different metals of which an alloy is composed; but while the different quantities are being measured for one alloy, the unit must not be changed. Thus: In the example given, if we take 33 *ounces* of copper, we must take 25 *ounces* of zinc; or, if we take 33 *pounds* of copper, we must take 25 *pounds* of zinc. In short, "33 parts of copper," means 33 units of weight, and "25 parts of zinc," means 25 of the same units of weight.

(4) F. E. H., ———, asks: Will you please inform me of an expeditious method of making small round holes from ⅝ to 2 inches, through glass? *A.*—Put a piece of brass tubing in a drill press spindle, the outside of the tube being equal to the size of the hole you desire to make. Feed it with emery and water.

(5) C. F. B., ———, asks: 1. Please give me a rule to find the back pressure in a cylinder without the use of an indicator? *A.*—There is no rule for this, and it cannot be determined except by the indicator or some form of gauge. 2. What pressure will there be on a diamond point planer tool, the table traveling 12 feet per minute, taking a cut $\frac{3}{16}$" deep, and with a feed of $\frac{1}{16}$"? *A.*—We have no data on this subject, but it is evident that the pressure will vary widely, depending upon the nature of the metal cut and the form of the tool. A diamond point tool may mean almost anything from a tool which is ground nearly square across the face and merely crowds or jams the metal off, to one ground with such sharp angles as to cut with comparative ease so long as the edge stands up to the work. In the AMERICAN MACHINIST issues of September 11 and 18, you will find some records of experiments made by James F. Hobart, from which you may be able to deduce something applicable to your case.

(6) F. L. O., Bangor, Me., writes: In compound boat engines, what proportion should the low-pressure cylinder be to high-pressure cylinder, and at what part of the stroke should the cut off take place? For a 4¼x6 inch H. P. cylinder what size should the L. P. cylinder be? *A.*—A rule in general use is to make the cylinder ratio equal to the total ratio of expansion multiplied by the decimal part of the stroke, completed by the small piston when the steam is cut off in its cylinder. Thus: Suppose the total ratio of expansion of steam is 6 (which we believe to be a good ratio of expansion for your class of engine), and that the steam is cut off at 0.5 stroke in the small cylinder, then the ratio of the cylinders is equal to $6 \times 0.5 = 3$. The cross-sectional area of a cylinder 4¼ inches diameter is 14.18 square inches, and $14.18 \times 3 = 42.54$ square inches for cross-sectional area of the large cylinder; the corresponding diameter will be 7⅜ inches very nearly. We should make the low-pressure cylinder 7½ inches diameter, and cut off steam in the high-pressure cylinder at half stroke.

(7) J. R., Montreal, Canada, writes: I am constructing a machine for cutting and otherwise manipulating plate. The first process consists in cutting up in strips iron or steel plates, usually one foot long and three inches wide by one-eighth of an inch thick. These plates are fed automatically to the cutter by means of rollers. The rollers are made of steel, one inch diameter. The top rollers are pressed down on the plate by spiral springs. Now my trouble is that, the plate having to be cut hot, heats up the whole feed carriage, rollers and castings, and burns out the oil, causing rapid wear of the bearings, and also takes the temper out of the springs. I cannot make the rollers any larger in diameter. Now what I wish to ask is: Can you suggest any remedy for this? or, are there any metals that would be more suitable than cast-iron or steel? The working of the machine is very good with this one exception. In about twenty minutes the rollers get heated to a blue color, and, of course, there is no use putting oil on them. *A.*—We see no other way of overcoming the trouble than to make the rollers of steel, and bore as large a hole through each as is consistent with strength, and keep a circulation of cold water through them.

(8) F. P., South Oil City, Pa., sends us a printed report of a Worthington duplex engine No. 3, and asks: Is the duty of the pump correctly given? If it is, will you please explain how they calculate it, and what they mean by duty? *A.*—By "duty" is meant the number of foot-pounds of work done by the consumption of 100 pounds of coal. Thus the duty of a pumping engine that will do the equivalent of lifting 100,000,000 pounds one foot high for every 100 pounds of coal consumed, is said to be 100,000,000. This has no reference to the capacity of the engine; that may be large or small. So far as the engine is concerned, this takes account of the effective, and not the indicated power. It is usually calculated from the pressure against which the pump piston works, plus the equivalent pressure of lifting the water from the well. The resistance which the pump piston must overcome is commonly determined by a pressure-gauge on the rising main; to the pressure indicated by this gauge is added the pressure due to its height above in the well, measured when the pump is working. The sum of these pressures will be the resistance against which the pump piston works. You may obtain the duty approximately by the data given in the report; thus, for instance: Multiply the number of gallons pumped by 8.331 (the weight in pounds of one gallon of water), and multiply the product by the given height; the result will be the number of foot pounds of work performed. Divide the number of pounds of coal consumed in pumping by 100, and divide the foot pounds of work performed by this last quotient; the result will be the duty of the pump, and agrees closely with the duty given in the report. Undoubtedly some other allowance has been made, of which no data is given. 2. Relating to your answer to Question 449, I would like to ask where one must stand to see whether the machinery is running with or against the sun? *A.*—It makes no difference where you stand.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Pattern and Brand Letters. Vanderburgh, Wells, & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Iron Planers from 16" to 36" wide by any length. H. C. Pease & Co., Worcester, Mass.

Round Adjustable, Round Solid, and Square Dies, all sizes. Mfd. by S. W. Card & Co., Mansfield, Mass.

Patent Attorney. R. G. DuBois, 715 11th st., Wash., D. C., procures first-class patents for inventors.

Wrist-pin Machines. Pedrick & Ayer, Philadelphia, Pa.

Horizontal and Radial Drilling Machine. Pedrick & Ayer, Philadelphia, Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

The hook on steam engines is being supplanted by the Dill disconnecting device made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Dec. 12, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

25" Upright Drills a specialty. Finely made,
28" great capacity, quickly operated, prices low.
32" Send for list of firms using our Drills. J. E.
36" Snyder, Worcester, Mass.

25" "Only Drill Press built on
32" 'Ko-rekt' principles,
37" even if they come from Jersey."
42" Gould & Eberhardt, New Ark, N. J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages. Illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Wanted—Parties to manufacture a superior steam specialty—patented—at reasonable prices, carry a stock, and charge interest on such stock so carried until sold. Sales made by owner, who will be on the road. Collections made through the manufacturer. No risk, since goods are marketable. Address H. C., care AMERICAN MACHINIST.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller.
Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices.
Consulting Expert and Constructing Engineer.
Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Just concluded. "Modern Locomotive Construction." By J. G. A. Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the AMERICAN MACHINIST containing the entire set, sent by mail to any address in the U. S., Canada or Mexico, for $5.30, or single copies 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

Patterson, Gottfried & Hunter (Lim.), 146-150 Centre st., N. Y., carry a complete stock of Brush, Copper, Celluvert Fiber, Oiled Paper, Hard Rubber, Rod & Sheet Brass, Brass, Copper & Iron Wire, Self-Hardening Tool Steel, Set & Cap Screws, Machine Bolts, Machine & Wood Screws, Taps & Dies, Files and Twist Drills, Blowers & Forges, Machinery, Tools & Hardware, Gear Wheels, Wood Pulleys, Shafting, Hangers & Belting. General factory supplies.

Pratt Institute, Ryerson st., between DeKalb and Willoughby aves., Brooklyn, N. Y.
Second term, day and evening classes in all departments, begin Jan. 2, 1890.
Department of Mechanic Arts.
New evening classes in turning, pattern making and machine shop work.
Also classes in electrical construction—lectures and laboratory work.
Applicants for the above must be at least seventeen years of age.
Afternoon classes in carpentry and forging for boys of fourteen years of age or over.
For application blanks and further information, apply to F. B. Pratt, Secretary.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Dec. 5, 1889 issue, 91 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15" to 88" swing, planing machines 48"x45"x10', 53"x50"x12', 17"x14"x24', 72"x69"x24', and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel, also steam hammers and two 8"x16" and one 10"x20" Rider cut-off engines.

MANUFACTURES

Magill Brothers will build a shoddy mill at Fort Fairfield, Maine.

Weeks & Co., Belmont, N. H., will *put up a* plant for making boxes.

The Atlanta Glass Co., of Atlanta, Ga., contemplates enlarging its works.

The Kingsland Steel Company is a new enterprise talked of at Pittsburgh, Pa.

Sutherland & Blackman will build a machine shop and foundry at Tallapoosa, Ga.

D. A. Kilham will, it is reported, move his box manufactory from Lynn to Beverly, Mass.

W. E. Tillottson is building an addition, 60x100 feet, to his worsted mill at Pittsfield, Mass.

The Bridgeport (Ala.) Land and Improvement Co. is interested in building a machine shop.

The Rhinelander Lumber and Shingle Company, Rhinelander, Wis., is building a saw and shingle mill.

The Moosehead Pulp and Paper Co., it is believed, will build their new mill at Carratunk Falls, Maine.

The Ferry Lumber Co. has begun the erection of a large saw-mill at Tacoma, Wash., to cost $300,000.

The Paige Tube Co., Warren, Ohio, has purchased land adjoining the works, upon which a rolling mill will be built.

The Central Machine and Foundry Company, Quincy, has filed articles of incorporation. Capital stock, $35,000

The Apalachicola (Fla.) Iron Works Company has been organized, to do a foundry and machine shop business.

The town of Maynard, Mass., has formed a board of trade, the object being to induce manufacturers to locate there.

A company has been formed with which H. H. Beach is connected, to build a malleable iron works at Litchfield, Ill.

The Middleton Machine Company, Middleton, Ohio, have issued a new circular of Shartle's lathe dogs and safety set collars.

The Collins Manufacturing Company, Jackson, Mich., wagon manufacturers, are making extensive additions to their works.

The Gautier Steel Department of the Cambria Iron Company, at Johnstown, Pa., is adding new machinery to increase the output.

The Massasoit Machine Co. has been organized at Fall River, Mass., to do a business in die sinking, pattern making, nickel plating, etc.

A company known as the Cyclone Fan Co. has been organized at Streator, Ill. The company will manufacture mine and ventilating fans.

The citizens of Lisbon Falls, Maine, are holding a series of meetings with a view to raising subscriptions with which to build a shoe factory.

The Goodyear Gossamer Co., of Hudson, Mass., will erect a two-story addition to the building, for cementing and preparation of pure rubber.

There is water-works agitation at Birmingham, Ala.; Holliston, Mass; Romeo, Mich.; Ogden, Utah; Cheney, Wash.; Reading, Mass; Litchfield, Minn.

The Richards Paper Company are busy pushing ahead the erection of their mill at South Gardner, Maine. It is intended to make this mill first-class in every particular.

Work on the railroad to connect Homestead, Bessemer and McKeesport, Pa., will be begun in a few days. The road will connect the Edgar-Thomson Steel Works, the Homestead Mill and the National Tube Works, with the principal railroads of Pittsburgh, and with each other.

All the capital stock has been subscribed to the Denison Manufacturing Company, Denison, Tex., and work is to commence on the mill in about sixty days.

The Philadelphia post office has on trial a letter stamping machine run by electricity. It cancels about 25,000 letters an hour, and registers each letter stamped.

The North Canadian river will be tapped six miles above Oklahoma, I. T., and water power for manufacturing purposes thus obtained. It is said that large power will be obtained.

A charter has been granted to the Reading (Pa.) Rolling Mill Company. Capital, $150,000. The incorporators are H. Cofrode, Wm. Nelson West, Wm. Nolan and Frank H. Saylor.

The contract for the Memphis & Charleston Railroad shops has been let. The blacksmith and boiler shops will be 90x100 feet, the machine shop 100x200 feet, and the car shop 90x200 feet.

We have received catalogue No. 1 from C. B. James, Chicago. Mr. James is a dealer in machinists' tools, and the catalogue is well illustrated with tools from some of the best makers.

The Doersom Carriage Company, recently incorporated, now occupy the old works of the Lancaster Carriage Company, at Lancaster, Pa. Geo. S. Norbeck is at the head of the new company.

The West Coast Manufacturing and Investment Company has been incorporated, with a capital stock of $25,000, and will erect saw, shingle, planing mill and other wood-working machinery, at Ballard, Wash.

The Excelsior Paper Company, Holyoke, is building an engine-room, 30x25 feet, to accommodate a fifty horse-power steam engine, which will supersede the present one, and will be used to run the 62-inch paper machine.

The Alabama Lumber Co. will build a factory for the manufacturing of dressed lumber for building purposes, at Ft. Payne, Ala., including steam dryer of 10,000 feet capacity per day. The company will also put in machinery for turning out carriage stock and other material.

Franklin V. Strickland and Albert B. Smith, who have been doing business under the firm name of the Foxcroft Foundry and Machine Co., at Foxcroft, Maine, have dissolved partnership. Mr. Strickland will continue the business under the name of Foxcroft Foundry and Machine Works.

The assignees of B. & J. W. Belcher have disposed of the entire plant and patterns of that concern to the Belcher & Taylor Co., manufacturers of agricultural implements at Chicopee Falls, Mass. The Belcher & Taylor Company will probably transfer the business to their old stand, and employ more hands.

The Laconia Car Co., of Laconia, N. H., has been incorporated, with the following officers: President and general manager, Perley Putnam; treasurer, Orran W. Tibbetts; clerk, William E. Putnam, superintendent, Charles E. Fyre. John C. Moulton resigned the position of treasurer, and Mr. Tibbetts was elected to fill the vacancy.

The Ohio Valley Steel Company is the name of a newly incorporated company with a capital of $400,000, that has been incorporated in Cincinnati for the purpose of manufacturing steel wire, wire nails and barb wire. The principal incorporators are the members of H. Belmer & Co., and the Cincinnati Barb Wire Fence Company, together with a number of capitalists. They propose to fit up a fine rod mill.

The St. Louis *Age of Steel* says: The Valley Steel Company formed to operate the plant known for years as the Western Nail Works, at Belleville, Ill., has been chartered under the laws of Missouri, with a capital stock of $150,000. The incorporators are Chas. A. McNair, George O. Carpenter, Jr., George S. Engell, George J. Plant, B. S. Adams, F. W. Oliver and T. A. Meysenburg. The works in question were acquired by purchase from Col. McNair, as trustee named above, as one of the incorporators of the new company, on Saturday last, and will be started up January 1st, with about 300 hands. Col. T. A. Meysenburg says the product will be soft steel in the form of slabs and billets, together with nails. The Tudor Iron Works are intimately connected with the enterprise, and will be supplied from the Belleville plant with billets, for the manufacture of light rails, etc. The office of the new company is in the apartments of the Tudor people, Third and St. Charles streets.

The well-known Whitman Agricultural Works, formerly located at Winthrop, of which W. E. Whitman was the proprietor, and which were destroyed by fire some two years ago, have been re-established at Auburn [Maine], and a corporation known as the Whitman Agricultural Works has been organized, with a capital of $100,000. The works are now being built, and will be equipped with the latest improved machinery, and will be ready for manufacturing about January 1st, 1890. It is the intention of the company to make the works first-class in every particular, and fitted for the manufacture of all kinds of agricultural implements and farm machines. The establishment will be under the supervision of W. E. Whitman, the former proprietor of the works at Winthrop. The company will carry on the manufacture of a general line of agricultural implements. Their facilities will be second to none, and it will be their aim to maintain and increase the high reputation of the Whitman agricultural machinery.—*Industrial Journal.*

Machinists' Supplies and Iron.

NEW YORK, Dec. 27, 1889.

Iron—American Pig.—No prices have as yet been fixed for 1890, though orders are being placed subject to the new scale when announced. Prices for 1890 still depend upon the action of the Thomas Iron Co., which is as yet uncertain. Most of the contracts booked are at prices to be named hereafter, though some are on a basis of $20 to $20 50 for No. 1 X Foundry. Firmness characterizes the market throughout. Prices rule at $19 50 to $20.50 for No. 1 X Foundry, $18 to $18.50 for No. 2.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—A competent bobbin and shuttle tool maker. Durham Bobbin & Shuttle Co., Durham, N C.

Foreman and contractor wanted, who can handle men and do good work promptly. Address Steam Engine, care AMERICAN MACHINIST.

Wanted—Foreman boiler works who can manage about 25 men and get out good work at lowest cost. Address A. J. P., AMERICAN MACHINIST.

Wanted—A first-class foreman for foundry. Steady employment. State exp. and salary. Also one pattern maker. D. J. Murray Mfg. Co., Wausau, Wis.

A thorough machinist and tool maker, having held position as foreman, will be open for engagement after 1st Jan. Address Box 61, AMERICAN MACHINIST.

Wanted—Permanent job by first-class machinist; age, 24. Mill or factory preferred, or tool or repair work. Address Box 65, AMERICAN MACHINIST.

Wanted—A first-class draftsman; one who has had shop experience preferred. Address J. H. McEwen & Co., Manufacturers of Engines, Saw-mill and Tanning Machinery, Ridgway, Pa.

Wanted—A mechanical draftsman. $14 per week. Good opening for a young man. Also a tool maker and machinist who has had experience in handling help. Address C. & M., 234 W. 29th st., New York.

Wanted—A 1st-class draftsman who has had exp. in designing machine tools and special machinery, tools, fixtures, etc. Must be up to the times and know something about shop system. State age, exp. and pay expected. Address Box 67, AM. MACHINIST.

Wanted—Mechanical engineer, experienced in designing and building modern automatic high-speed engines (plain and compound). One who is capable of taking charge of correspondence, and acting as general manager of office and shops Location, Southern Pennsylvania. Box 64, AM. MACHINIST.

Wanted—Superintendent for pipe mill. The applicant must be thoroughly acquainted with all the details of the pipe business, must be able to construct and run either Bell, Butt or Lap-Weld Furnaces. Must understand the use of natural gas as fuel, and all that pertains to Siemens Furnaces. Apply to Oil City Tube Co., Oil City, Pa.

Mechanical engineer, now in New York City, 32 years of age, a technical graduate, unusual experience in design and manufacture of steam, hydraulic and general machinery, also in taking out patents, desires a superintendency of works, preferably where he can invest several thousand dollars. Has worked up through all departments, and would take entire charge. No objection to good location at a distance. Please give particulars as to location, character and extent of business. Address Box 68, AMERICAN MACHINIST.

Wanted—A young American man, about 35 years of age (Yankee preferred), to take entire charge of a first-class machine shop employing 100 men, on fine machinery of medium weight, located in a wide-awake, flourishing city near Boston, Mass. Must be a man of sound bodily health, strong and willing to work, of good character and habits (*not a user of tobacco or intoxicating liquor*), with plenty of that *good* sense erroneously styled "common." Good general education, a *first-class A 1 mechanic*, well up in modern machine shop practice, and interested and anxious to *keep* up. With *practical* ingenuity to devise ways and methods and special tools—not a "tinker" or inventor (?) of "traps." Able to plan work to best advantage and manage men, and develop good men from good apprentice stock. First-class tools, drawings and all facilities will be furnished, and a liberal salary paid to the right man—when we find him. Look this over *carefully*, and if you *can* "fill the bill" we can give you a splendid chance, where you may "grow" as fast as you can, but, if you can *not* "fill the bill," don't try, for we shall speedily discover it. Address, giving full particulars, salary expected, age, experience, references, etc., Box 66, AM. MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

⅜" Portable Drill, $100. Am. Tool W'k's., Clev. O.

Koopman's Scales for quick measurements.

Glass Triangles. F. E. Harthan, Worcester, Mass.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

For Sale Cheap—8 H. P. Clerk gas engine; little used; in good order. C. S. Brown, Superintendent, Terre Haute, Ind.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—More heavy and light machine work, also manufacturing, by well-equipped machine shop. Address Box 1,446, New Haven, Conn.

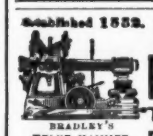
For Sale—Part or whole interest in foundry and machine shops in Nebraska. Address J. C. K., Advance Office, 155 La Salle st., Chicago, Ill.

For Sale—An established mach. business, protected by valuable patents. Can be much enlarged by judicious management. C. M. W., AM. MACHINIST.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

For Sale—Tools, patterns and fixtures for the jobbing machine business. Good will and list of customers will be sold at a great bargain at Sioux City, Iowa, the most enterprising, progressive and rapidly growing city in the Northwest, by the Sioux City Engine Works. For full information, call on or address Sioux City Engine Works, Sioux City, Iowa.



Established 1832. **BRADLEY'S POWER HAMMERS**

The BEST in the WORLD

RUN BY BELT.

Over 1500 in USE

BRADLEY'S HEATING FORGES

Indispensable in all shops to keep BRADLEY'S CUSHIONED HAMMERS and men fully employed and reduce the cost of production.

BRADLEY & CO. SYRACUSE, N.Y.

63 Murray st. NEW YORK: 98 Sudbury st. BOSTON, MASS.

Bolt and Nut Machinery.

12 Sizes of National Bolt Cutters.
6 Sizes and Styles of Rapid Bolt Cutters.
5 Sizes and Styles of Bolt Pointers.
15 Sizes and Styles of Bolt Headers.
12 Sizes and Styles of Nut Machines.
14 Sizes and Styles of Tappers.
3 Sizes and Styles of Washer Machines.
3 Sizes and Styles of Spike Machines.
2 Sizes of Car Link Machines.
3 Sizes of Car Pin Machines.
7 Sizes and Styles of Wire Nail Machines.
5 Sizes and Styles of Bulldozers.

Also large variety of Tools in this line, making complete outfits for Bolt shops. Catalogue sent on application. Apply to

THE NATIONAL MACHINERY CO.,
TIFFIN, OHIO.

JOHN WILEY & SONS, NEW YORK, PUBLISH

WILSON'S STEAM BOILERS, 12mo, cloth,	2.50
THURSTON'S MANUAL OF STEAM BOILERS, 8vo, cloth,	6.00
FORD'S BOILER MAKING, 18mo, cloth,	1 00
THURSTON'S STEAM BOILER EXPLOSIONS, 12mo, cloth,	1.50
GRIMSHAW STEAM ENGINE CATECHISM, 18mo, cloth,	1.00
DITTO DITTO VOL. II. 18mo, cloth,	1 00
WHITHAM STEAM ENGINE DESIGN, 8vo, cloth,	6.00
HEMENWAY'S INDICATOR PRACTICE, 12mo, cloth,	2.00
PRAY'S TWENTY YEARS WITH INDICATOR, 8vo, cloth,	$2.50

DESCRIPTIVE CATALOGUE GRATIS.

"Star" Foot Lathe Swings 9x25 in.

LATHE

Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

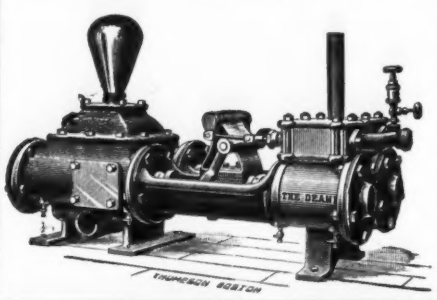
Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N. Y.

Maslin's Patent Pulsator Pump.

PAT. FEB. 12, 1889.

Cheapest and Best Automatic Steam Vacuum Pump. Handling DIRTY and GRITTY LIQUIDS without Wear, Oil or Care. Simple, Economical, Efficient & Durable. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining & General Hydraulic Purposes. Write or call for Circulars. JOHN MASLIN & SON, SOLE MANUF'RS, 165-167 1st St., Jersey City, N. J.



THE DEANE STEAM PUMP CO.,

HOLYOKE, MASS.,

New York, Boston, Chicago, Philadelphia, St. Louis,

Manufacturers of

STEAM and POWER

PUMPS

FOR ALL PURPOSES.

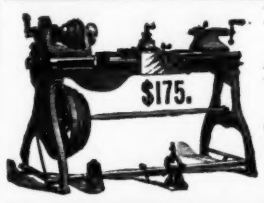
SEND FOR CATALOGUE.

TOOL AND DIE STEEL.

Drill Rods. Sheet Steel. Fine Wire. Machinery and Spring Steel. Forgings. Coiled Springs. Die Blocks. Steel for Hardware of all kinds.

CRESCENT STEEL CO.,

CHICAGO, ILLS. PITTSBURGH, PA. NEW YORK, N. Y.



Improved Screw Cutting Foot and Power **LATHES**

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

THE SEBASTIAN-MAY CO., 167 W. 2d St.,
CINCINNATI, O.

MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE

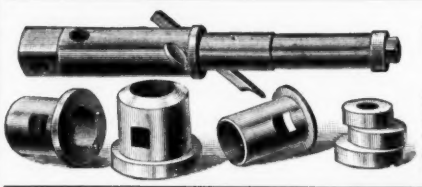
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.

CAN BE FORGED HOT.

Rods for pumps and bolts. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Ingot metal for car and engine bearings. Spring wire.

ANSONIA BRASS & COPPER CO.,
Sole Manufacturers.

Send for Circular. CHICAGO. NEW YORK.

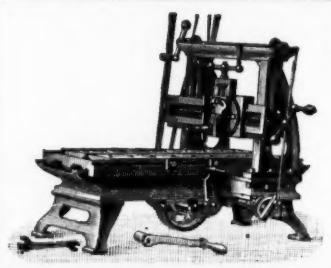


— THE —

Vance Lightning Flue Cutter

For removing Flues from Locomotive and Stationary Boilers One man can cut five hundred (one end) in a day. In use in the leading Railroad Shops of the country. Combination Cutter for removing 2 in., 2 1-4 in., 2 1-2 in. and 3 in. Flues, $50. Sent on approval to Railroad Co.'s. Liberal Discounts to the Trade.

VANCE TUBE CUTTER CO., Geneva, N. Y.



SMALL POWER OR HAND PLANER.

FOR ANY SMALL WORK.

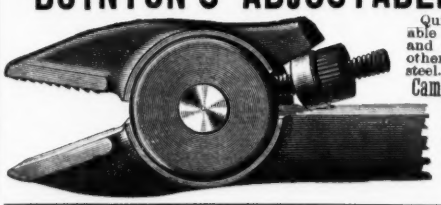
Weight of Platen 100 lbs.

A. J. WILKINSON & CO.,

184 Washington St., BOSTON, MASS.

SEND FOR CIRCULAR.

BOYNTON'S ADJUSTABLE ALLIGATOR WRENCH.



Quick and handy in adjustment. Invaluable for work on clipped pipe, in close coils and corners that cannot be reached with other wrenches. Made entirely of drop forged steel. Six sizes.

Campbell Printing Press and Mfg. Co., Mfrs.

160 WILLIAM ST., NEW YORK.

325 DEARBORN ST., CHICAGO.

PATENT UNIVERSAL SCREW-CUTTING CENTER DEPTH ANGLE AND **TWIST DRILL GAUGE.**

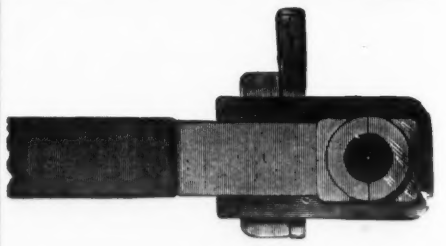
J. WYKE & CO.,

Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular

Barnes' Foot-Power Machinery.

Complete outfits for Actual Workshop Business. A customer says: "Considering its capacity and the accuracy of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day, and at night feel as little tired as if I had been walking around." Descriptive Price List Free.

W. F. & JOHN BARNES CO.,
1995 RUBY ST., ROCKFORD, ILL.



SAVE MONEY,

BY BUYING YOUR

STRAP JOINTS

FROM COOKE & CO.,

22 CORTLANDT STREET, NEW YORK

WRITE FOR PRICES,

Mentioning *American Machinist.*

BEVEL GEARS,

Cut Theoretically Correct.

For particulars and estimates apply to

HUGO BILGRAM,

Machinist,

Successor to

BREHMER BROS.

440 N. 12th St., Philadelphia, Pa.

GEO. F. BLAKE MANF'G CO.

BUILDERS OF EVERY VARIETY OF

95 & 97 LIBERTY ST., NEW YORK. 111 FEDERAL ST., BOSTON.

WATER WORKS PUMPING ENGINES A SPECIALTY

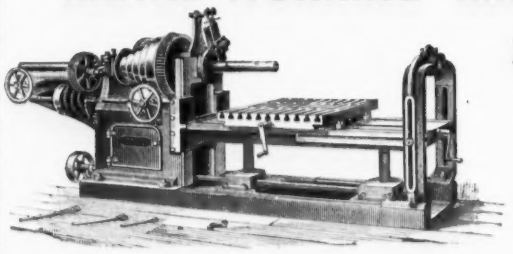
BETTS MACHINE CO., WILMINGTON, DEL.

MAKERS OF

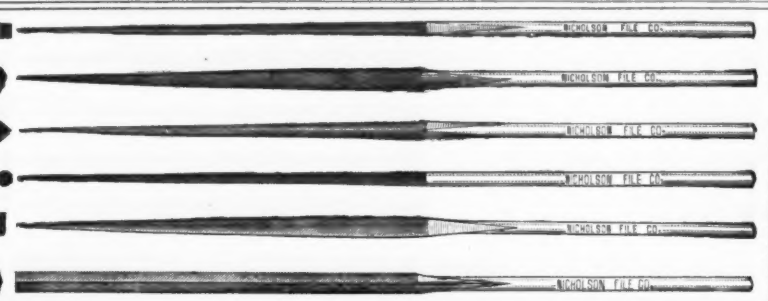
METAL-WORKING MACHINE TOOLS

FOR

Locomotive, Bridge & Engine Builders,
Railroad, Car & Machine Shops
AND
Iron and Steel Works
Generally.



FILES and RASPS.



PROVIDENCE, R. I., U. S. A.

"CENTENNIAL" OILERS.

NEW STYLES, SKELETON FRAME, ADJUSTABLE SCREW AND SLIDING TOP. (See cut.)

PRICES REDUCED.

IMPROVED HANDY, VOLUNTEER AND NATHAN SIGHT FEED LUBRICATORS.

GRESHAM AUTOMATIC and MONITOR INJECTORS, EJECTORS, &c.

Nathan Manufacturing Co.,
92 & 94 LIBERTY STREET,
SEND FOR DESCRIPTIVE CATALOGUES. NEW YORK.

Established in 1874.
CLEVELAND TWIST DRILL CO.
Corner Lake & Kirtland Sts., Cleveland, O
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

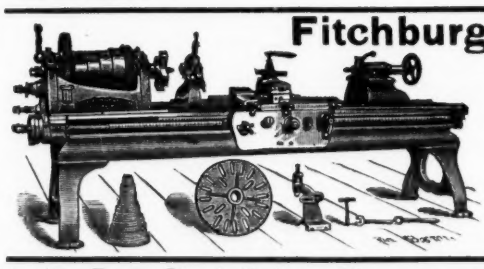
CRUCIBLE AND OPEN HEARTH
CAMERON SELF-HARDENING
STEEL
ESTABLISHED 1859.
HOWE, BROWN & CO., L't'd, Mfrs., Pittsburgh, Pa.
BRANCH OFFICES: 12 Cliff St., New York. 127 Oliver St., Boston. 228 Lake St., Chicago.

WHAT USERS THINK OF THE

Hall HALL STEAM PUMP CO., **Steam** — **Duplex** 91 LIBERTY STREET, NEW YORK. **Pump.**

It gives me pleasure to say that the Ammonia Pump 3½x1¼x4, you sold me, is a perfect success. No leaks nor any trouble about it, though tested severely. Have pumped ammonia of 25 to 28 degrees right along. I have never used, nor have I seen, any other ammonia pump that does as well.

D. L. HOLDEN, for NEW PROCESS COMPANY, New York City.

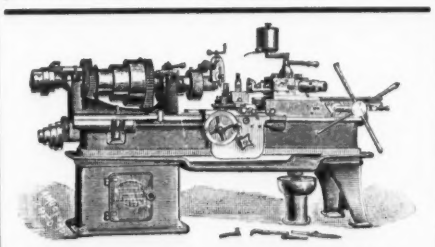


Fitchburg Machine Works,
Manufacturers of
Metal-working Machinery.
OFFICE AND WORKS:
Nos. 13 to 21 Main Street.
FITCHBURG, MASS.
SEND FOR CATALOGUE E.

Root's Force Blast Rotary Blower.
FOR
FOUNDRIES, SMITH SHOPS, PNEUMATIC TUBES, VENTILATION, ETC.

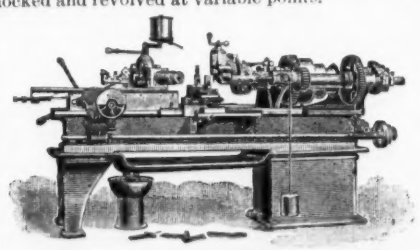
SLOW SPEED, POSITIVE BLAST, PERFECTLY BALANCED.
Best Mechanical Construction.
P. H. & F. M. ROOTS, Manufacturers,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt. } 22 Cortlandt St.,
COOKE & CO., Selling Agts. } NEW YORK.
In Writing, Please Mention This Paper.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
☞ Our New and Revised Catalogue of Practical and Scientific Books, 80 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

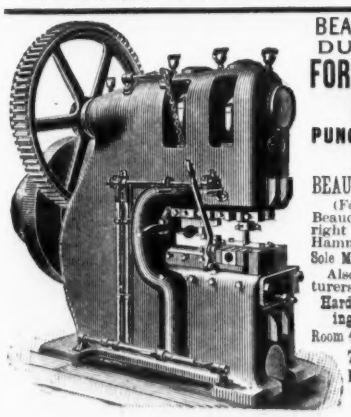


20-in. SCREW MACHINE,

with patent friction Clutch Head, Chasing Bar, Lathe Carriage with taper attachment, and Turret supplied with a device by which it can be unlocked and revolved at variable points.



BRIDGEPORT MACHINE TOOL WORKS,
E. P. BULLARD, Prop. BRIDGEPORT, CONN.



BEAUDRY'S DUPLEX **FORGING PRESS,** PUNCH AND SHEARS.
BEAUDRY & CO.
(Formerly of Beaudry's Upright Power Hammer.)
Sole Manufacturers.
Also Manufacturers of Hard Coal Heating Forges.
Room 4, Mason B'dg.
70 Kilby St.,
Boston, Mass.

REDUCED PRICES OF

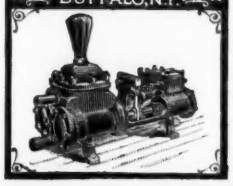
LECOUNT'S LIGHT STEEL DOG

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	3/4	$ .35	8	2	$1.10
2	7/8	.35	Small Set of 8		5.50
3	3/4	.50	9	2 1/8	1.40
4	1	.60	10	3	1.50
5	1 1/4	.75	11	3 1/8	1.70
6	1 1/8	.85	12	4	1.90
7	1 3/4	1.00	Full Set of 12		12.00

C. W. LeCOUNT,
SOUTH NORWALK, CONN.
Western Agent, S. A. SMITH 23 South Canal St., Chicago, Ill.

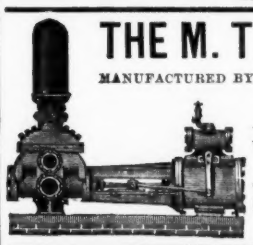
Dean Bros. Steam Pump Works,
Indianapolis, Ind.
Boiler Feeders, Duplex Pumps,
Fire Pumps, Send for Catalogue

THE BUFFALO STEAM PUMP CO.
MANUFACTURERS OF STEAM PUMPS.
FOR ALL DUTIES.
BUFFALO, N.Y.



FOR SALE AT FACTORY PRICES BY
Branch Offices, H. Eaton, Chicago, Ill.; James Beggs & Co., N. Y. City; Henry I. Snell, Philadelphia, Pa.; George Worthington Co., Cleveland, Ohio; Hendy Machine Works, San Francisco, Cal.; J. Baur, Manistee, Mich.; Liddell & Co., Montgomery, Ala.; Shaw, Kendall & Co., Toledo, Ohio; Wickes Bros., E. Saginaw, Mich.; A. Leitelt, Grand Rapids, Mich.; Sherriff Mach'y Co., Pittsburgh, Pa.; Flynn & Emrich, Baltimore, Md.; Columbus Supply Co., Columbus, O.; Rundle, Spence & Co., Milwaukee, Wis.; Davis & Co., Rock Island, Ill.; Kerfoot Bros., Des Moines, Ia.; Walworth Supply Co., Boston, Mass.; Merrill-Stevens Eng. Co., Jacksonville, Fla.; C. S. Leeds Sup. Co., Minneapolis and St. Paul, Minn.; D. Elsinger, Scranton, Pa.; Gaines & Glover, Richmond, Va.; W. A. Wain, Detroit, Mich.; Kennedy & Pierce, Denver, Col.; Shellhorn & Rich, Cheboygan, Mich.; L. Emory & Co., Bradford, Pa.; Reading Scale and Mach. Co., Reading, Pa.; Dugan Bros., Salem, Ore.; Gardner & Co., Portland, Ore., and Tacoma, Wash.; E. F. Cooley, Lansing, Mich.; Port Huron Steam Fitting Co., Port Huron, Mich.; Hutchinson Mfg. Co., Jackson, Mich.; Ft. Worth Iron Works, Ft. Worth, Tex.; W. A. Roosevelt & Co., La Crosse, Wis.; S. C. Brooks, Eau Claire, Wis.; J. B. Simpson, Peoria, Ill.; Haxtun Steam Heater Co., Duluth, Minn.; Coleman & Co., New Orleans, La.; H. C. Burke Mfg. Co., St. Joseph, Mo.; J. J. Howden, Muskegon, Mich.; W. Pickett & Co., Warren, Pa.; H. F. Spencer, Green Bay, Wis.; Tennessee Range & Mfg. Co., Evansville, Ind.

THE M. T. DAVIDSON IMPROVED STEAM PUMP.



MANUFACTURED BY
DAVIDSON STEAM PUMP COMPANY.
WARRANTED THE **BEST PUMP** MADE FOR ALL SITUATIONS.
PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.
NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

TRUMP CHUCK.

The Best and Cheapest Chuck made. Will hold **STRAIGHT** or **TAPER** Shank Drills **ACCURATELY.**
3 sizes: ⅛", ¼" and ⅜".
Write for Prices to
TRUMP BROS. MACHINE CO.,
WILMINGTON, DELAWARE.

FINE TAPS, DIES, REAMERS, ETC.

LIGHTNING AND GREEN RIVER SCREW PLATES.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS.

ADAPTED TO ALL KINDS OF WORK.—POSITIVELY TRUE.
NICHOLSON'S EXPANDING MANDRELS.
W. H. NICHOLSON & CO., WILKES-BARRE, PENN'A.

WHY THIS IS PUT HERE!
For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the
NEW PULSOMETER,
CHEAPEST & BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.
More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.
Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A 1 Testimonials. Mailed Free.
FULSOMETER STEAM PUMP CO., 120 LIBERTY ST., N. Y.

PATTERNS called for and CASTINGS delivered anywhere in N. Y. City.

Iron Foundry of T. Shriver & Co.,
333 E. 56th St., N. Y. City.
CASTINGS IN QUANTITY AT FAVORABLE PRICES.

WIRE STRAIGHTENING AND CUTTING MACHINERY

Can be used in any Hollow Spindle Lathe.
COLLINS-GOODIN MFG. CO., St. Louis, Mo.

HICKORY BICYCLES
SEND FOR OUR 1890 CATALOGUE.
STERLING ELLIOTT, NEWTON, MASS.

WILLIAM JESSOP & SONS, L'D.
MANUFACTORY, SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.
JESSOP'S BEST TOOL STEEL
Gold Medal, Paris, 1889.
Importation Orders Promptly filled.
ALL KINDS OF Steel in Stock.

WORTHINGTON PUMPING MACHINERY
HENRY R. WORTHINGTON,
NEW YORK,
BOSTON PHILADELPHIA CHICAGO
ST LOUIS ST PAUL SAN FRANCISCO

SEND FOR Illustrated Catalogue.

Facts:—1889 marks the **30th YEAR** of the life of

THE HARRISON SAFETY BOILER.

The results obtained by many of the largest steam users of the country, who have used thousands of horse-power of them during that length of time, will warrant your investigating their merits when in need of power.

HARRISON SAFETY BOILER WORKS,
Germantown Junction, Philadelphia, Pa.

POND ENGINEERING CO.,

CONTRACTING ENGINEERS,

Engines, Boilers, Pumping Engines, Feed Pumps, Feed-water Heaters and Purifiers, Injectors, &c.

Send for ILLUSTRATED CIRCULAR.

St. Louis. Chicago. Kansas City. Omaha.

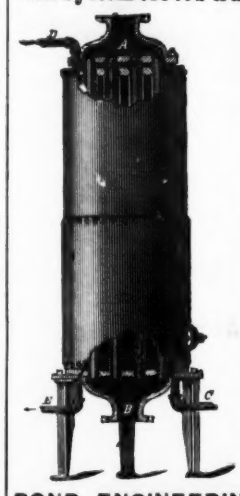
THOS. H. DALLETT & CO.
1305 Buttonwood Street,
PHILADELPHIA, PA.

Portable Drills,
Hand Drills,
Boiler Shell Drills,
Light Drill Presses,
Special Machinery.

SEND FOR CATALOGUE

This System of Feed Water Heater is the Best

AND THE



LOWE

is the simplest

HEATER

on the System.

Has Straight Tubes
With reliable provision for expansion, and will

HEAT AND PURIFY THE WATER

EQUAL TO ANY
With same Feet of Heating Surface and

Wear the Longest.

Send for description and Histories of Boilers and Feed Water Heaters to

Bridgeport Boiler Works
Bridgeport, Conn.

POND ENGINEERING CO., AGENTS,
ST. LOUIS, CHICAGO, KANSAS CITY, OMAHA.

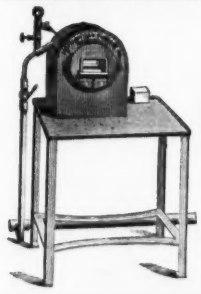
THE STERLING WATER TUBE BOILERS

Have unusually large steam and water spaces and well-defined circulation. The fire-brick furnace and almost vertical water tubes give remarkable economy of fuel with rapid and steady steaming. Dry steam at any pressure. Large mud-drum. First cost moderate.
Freedom from leakage and repairs. No cast metal. No hand-holes.
Three man-holes give quick access to every part of the boiler.

THE INTERNATIONAL BOILER CO., Ltd.,
74 CORTLANDT STREET, NEW YORK.

THE STANDARD

ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVES, ETC.
SECTIONAL PIPE COVERING.
ASBESTO-SPONGE NON-CONDUCTING COVERINGS.



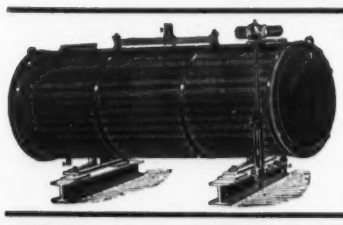
AMERICAN GAS FURNACE CO.,

DESIGNERS AND MANUFACTURERS

GAS BLAST FURNACES.

Send for Catalogue. Estimates made for any mechanical operation requiring **high, even** and **controllable temperature.**

No. 80 NASSAU STREET, NEW YORK.



The HOPPES Live-Steam Feed-Water Purifier,

Guaranteed to Prevent Scale in Boilers.

Using any kind of water. Hard Sheet Steel Troughs, *Easily Cleaned.*

HOPPES MANUFACTURING CO.,
Send for Catalogue D. SPRINGFIELD, OHIO.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS

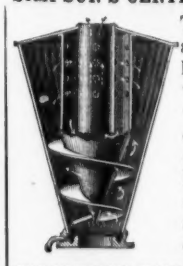
JAS. HUNTER & SON,
North Adams, Mass.

JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.

Pencils, Graphite Car Grease, Graphite Perfect Lubricator, Belt Grease, Crucibles, Plumbago Facing, Smoke-Stack Paint, etc.

Send for Illustrated Catalogue containing more information concerning Graphite and its uses than is in print elsewhere in any language.

SIMPSON'S CENTRIFUGAL EXHAUST HEAD.



Thoroughly entraps water and grease from the exhaust of a steam engine without back pressure, preventing them from spraying on the sidewalks and roofs of buildings; it protects the latter from injury, and passers by from annoyance and damage. Send for circular to

KEYSTONE ENGINE & MACHINE WKS.,
5th and Buttonwood Sts., Phila., Pa.,
Or A. T. ARTHUR, Selling Agent, 18 Cortlandt Street, N. Y.

WESTCOTT CHUCK CO., Formerly Oneida Steam Engine & Foundry Co., ONEIDA, N. Y.

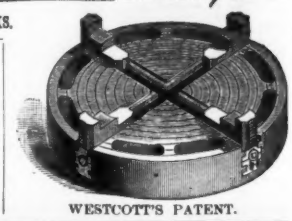
Manufacturers of all kinds of

LATHE AND DRILL CHUCKS

SEND FOR Catalogue.

SCROLL COMBINATION LATHE CHUCKS.

Diameter over all.	Will hold inside of Jaws.
4 9-16 in.	5 1-2 in.
6 in.	6 1-2 in.
7 1-2 in.	8 in.
10 1-8 in.	12 in.
13 1-4 in.	15 in.
16 in.	18 in.
18 1-2 in.	21 1-2 in.
21 1 4 in.	26 in.
24 in.	30 in.
30 in.	36 in.
36 in.	43 in.

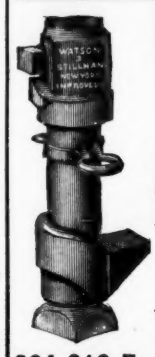


WESTCOTT'S PATENT.

WESTCOTT CHUCKS

FOR LATHES AND DRILLS,
COMPLETE ASSORTMENT CARRIED IN STOCK.

HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.



HYDROSTATIC MACHINERY,

PRESSES,
PUMPS,
PUNCHES,

ACCUMULATORS,

JACKS,
VALVES,
FITTINGS,
&c., &c.

WATSON & STILLMAN,
204-210 E. 43D ST., NEW YORK.

BUCK & HICKMAN, LONDON. L. ROFFO, PARIS.

INDEPENDENT CHUCKS.

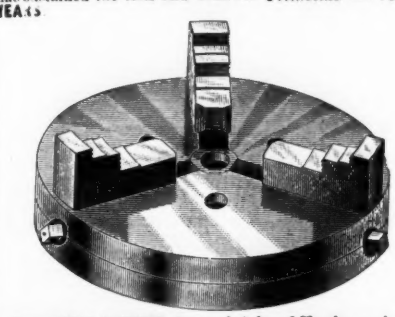
(See AM. MACHINIST, Nov. 5, 1887.)

Before buying Chucks of this class, write us for particulars of our latest improvements. Different from other makes, and we claim several points of superiority which we submit to the judgment of mechanics.

THE D. E. WHITON MACHINE CO.,
NEW LONDON, CONN.

"THE HORTON LATHE CHUCK"

has sustained the tests and been the **STANDARD** for **FORTY YEARS**



Over **THREE HUNDRED** sizes and styles of Chucks, made and kept in stock, by

THE E. HORTON & SON CO.,
WINDSOR LOCKS, CONN., U. S. A.
SEND FOR ILLUSTRATED PRICE LIST.

A NEW CATALOGUE OF

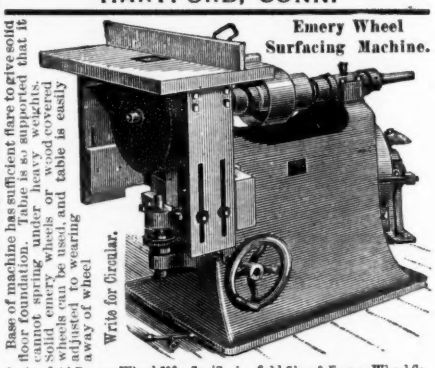
CUSHMAN CHUCKS

JUST ISSUED.

Containing new designs. Sizes and prices sent free on application to the

CUSHMAN CHUCK CO.,
HARTFORD, CONN.

Emery Wheel Surfacing Machine.



Base of machine has sufficient flare to give solid floor foundation. Tube is so supported that it cannot spring under heavy weights. Solid emery wheels or wood covered wheels can be used, and table is easily adjusted to wearing away of wheel. Write for Circular.

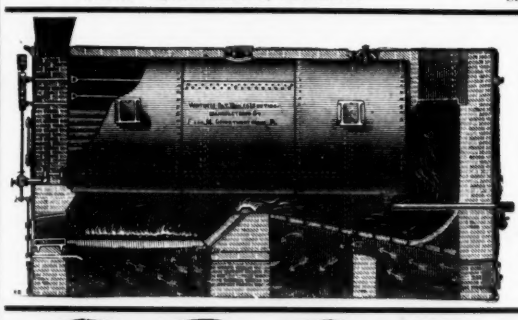
Springfield Emery Wheel Mfg. Co., Successors to Springfield Glue & Emery Wheel Co., SPRINGFIELD, MASS.

Weitmyer Patent Furnace,

For burning screenings, cheap fuel, etc.

Manufactured and Sold by

FOUNDRY AND MACHINE DEPARTMENT,
HARRISBURG, PA.

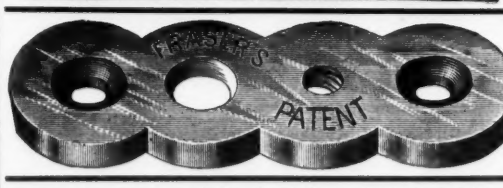


Ide Auto, Engines. Portable and Traction Engines. Steam Road Rollers. Boilers of all descriptions.

New York Office, FLEMING & KIMBALL, 17 Dey St.

New England Office, JOHN POST, JR. & CO., 70 Kilby St., Boston.

Baltimore Office, THOMAS K. CAREY & BRO., 35 Light St., Baltimore.



SAVE YOUR PATTERNS, BY USING

Fraser's Improved Rapping Plates.

They are cheaper and better than anything you can make.

For Descriptive Circular and Price List, ADDRESS

DONALD FRASER, MILWAUKEE, WIS.

PATENT OILERS, CYLINDER SIGHT FEED CUPS.

Government Regulation

POP SAFETY VALVES,

For Stationary, Marine and Locomotive Boilers.

J. E. LONERGAN & CO., BRASS FOUNDERS AND FINISHERS,
211 Race Street, Philadelphia, Pa.
1888 CATALOGUE FREE ON APPLICATION.

WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.

The best non-conducting material known for Steam Pipes and Boilers. Can be easily removed and repeatedly reapplied.

ITS PLASTIC NATURE INSURES AN ABSOLUTELY TIGHT JOINT.

Requires less thickness than any other covering.

FOSSIL MEAL CO., 2 Cedar St., N. Y.

Trade-mark. W. B. C.

—1889—

THE STILES & PARKER PRESSES STILL IN THE LEAD!!

GOLD MEDAL FOR SUPERIORITY IN PRESSES.

Punching, Stamping, Cutting, Blanking and Toggle-Joint Drawing Presses.

We have just been awarded the Gold Medal for

SUPERIORITY IN PRESSES

at the Paris Exposition, over all competitors.

THE STILES & PARKER PRESS CO.,
203-7 Center Street, NEW YORK. MIDDLETOWN, CONN.

Dies, Shears, Sprue Cutters and Stiles' Automatic Drop Hammers.

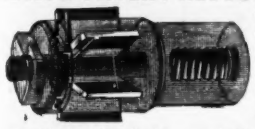
MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.

Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.

DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

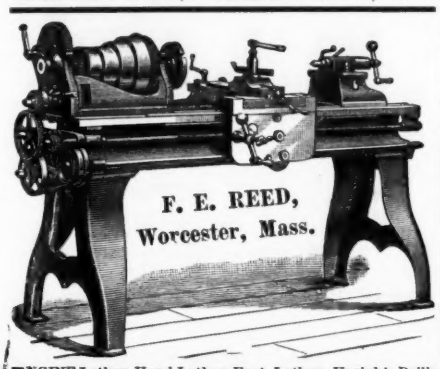
A NEW PATENT ADJUSTABLE REAMER,



thoroughly tested and practical. A set of five will ream any possible size, from 1 3-16 to 4¼ inch.

Send for Circular.

CRANSTON & CO., 57 PARK STREET, N. Y.



ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

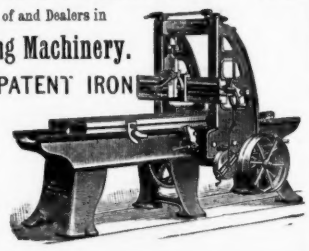
FLATHER ENGINE LATHES

14, 15, 16, 18, 20, 24 and 28 INCH SWING.
ANY LENGTH OF BED UP TO 22 FEET.

HILL, CLARKE & CO.,
General Selling Agents,
156 OLIVER ST., BOSTON, MASS.

L. W. POND MACHINE CO.

Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED PATENT IRON PLANERS A SPECIALTY.
152 Union St., WORCESTER, MASS.



FLATHER IRON PLANERS.

Beautiful Designs. Accurate Workmanship.
22, 24, 26 and 30 Inch.

HILL, CLARKE & CO.,
General Selling Agents,
156 OLIVER ST., BOSTON, MASS.

KEUFFEL & ESSER CO., 127 FULTON ST., NEW YORK.
FACTORY: HOBOKEN, N. J.
Manufacturers of **DRAWING MATERIALS, &c.**

SUPERIOR SWISS" DRAWING INSTRUMENTS.
"BEST GERMAN" DRAWING INSTRUMENTS.
PARAGON, DUPLEX, UNIVERSAL, ANVIL Drawing, **HELIOS,** Blue Process Papers, Scales, Triangles, T-squares, Drawing Boards, &c.
FULL CATALOGUE ON APPLICATION.

WILLIAM BARKER & CO.,

Manufacturers of
Iron and Brass Working
MACHINERY
140 & 142 E. SIXTH ST.,
Near Culvert,
CINCINNATI, O.
Send for Circulars and Prices.

A NEW JAW
about once a year will make this Cutter last until you forget when you bought it, as the body never wears out.

Warranted to Cut Straight.

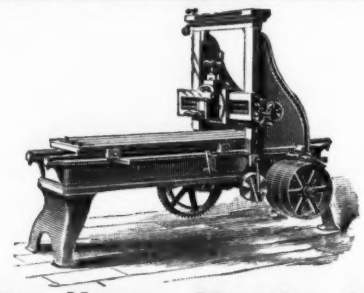
THE "EUREKA" PIPE CUTTER

IS THE BEST AND CHEAPEST MADE.

No. 1 Cuts	⅛ to 1 inch Pipe	$1.00	Nos. 1 and 3 will
No. 2 "	¾ to 2 " "	1.50	cut all sizes from ⅛
No. 3 "	1 to 2 " "	4.65	to 3 inch

Any Jobber can furnish this tool to you at these prices.

PANCOAST & MAULE,
243 and 245 South Third Street, Philadelphia.



New Haven Manf'g Co.

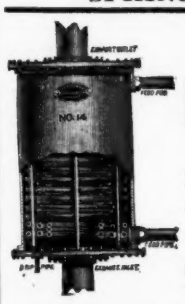
NEW HAVEN, CONN.

IRON-WORKING MACHINERY.

JONES & LAMSON MACHINE CO.,

SEND FOR CATALOGUE. WRITE FOR DISCOUNTS.

SPRINGFIELD, VT.



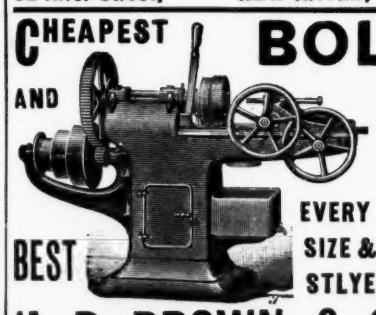
THE NATIONAL Feed-Water HEATER.

A brass coil Heater delivering water to the boiler at 210° Fahrenheit.

300,000 Horse Power sold. Prices Low. Satisfaction universal.

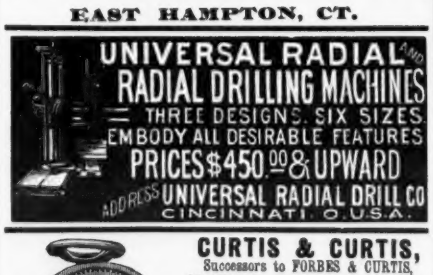
THE NATIONAL PIPE BENDING CO.,
82 River Street, NEW HAVEN, CONN.

CHEAPEST AND BEST BOLT CUTTERS.



EVERY SIZE & STLYE.

H. B. BROWN & CO.,
EAST HAMPTON, CT.


UNIVERSAL RADIAL AND RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI, O. U.S.A.

CURTIS & CURTIS,
Successors to FORBES & CURTIS,
66 JOHN ST., Bridgeport, Ct., U.S.A.
MANUFACTURERS OF
The FORBES PAT. DIE STOCK,
IMPROVED AND PERFECTED.
Pipe Cutting and Threading Machine, etc.
A portable cutting and threading machine with which one man can with ease thread pipe up to six inch diam. No vise is required.
SEND FOR ILLUSTRATED CATALOGUE.

OUR **NEW CATALOGUE OF TOOLS**
And Supplies sent free to any address on receipt of Ten Cents in Stamps (for postage).
Chas. A. Strelinger & Co., WOOD AVE. **Detroit, Mich.**

D. SAUNDERS' SONS, Yonkers, N.Y.

MANUFACTURERS OF
Steam & Gas Fitters' Hand Tools.
SEND FOR CIRCULAR.

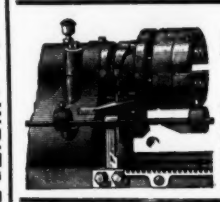
Pipe Cutting THREADING, AND Tapping Machines.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe-cutter made.

BUFFALO FORGES

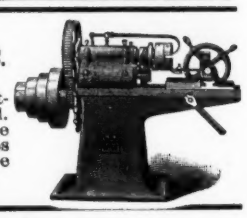
BLOWERS, EXHAUSTERS, HEATING FURNACES. HAND BLOWERS, BLACKSMITH DRILLS.
BUFFALO FORGE CO.
BUFFALO, N.Y.

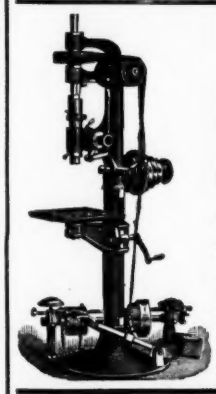
ADAMS
Automatic Bolt-Threading & Nut Tapping Machine.



Made in all Sizes to Cut from 1-4" to 6".

The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to **Capitol Mfg. Co., Chicago, Ills., U. S. A.**

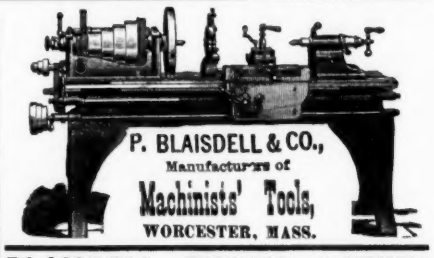




LUSCOMB & COREY,
NEW BEDFORD, MASS.
Mfrs. of
UPRIGHT DRILLS,
SPECIAL
Machinery & Tools.

This machine will drill to the center of 16 inches.
The spindle can be fed by either HAND or FOOT, and has a vertical movement of 11 inches. *Also an entirely new* feed arrangement.
Cone has four changes and all moving parts are balanced and capable of standing high speeds. It is very stiff and heavy and is made for doing first class work.

Send for Catalogue if interested.



P. BLAISDELL & CO.,
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

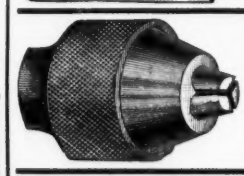
BLAISDELL ENGINE LATHES
AND
UPRIGHT DRILLING MACHINES.
GREAT VARIETY OF STYLES AND SIZES ON HAND.
HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.

Send $1.00 for
Catalogue D.

No charge when $10 worth of goods are ordered.

Over 550 pages, fully illustrated.

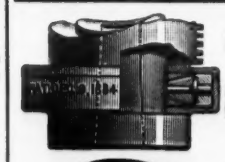
FRASSE & CO.,
92 PARK ROW, N. Y.



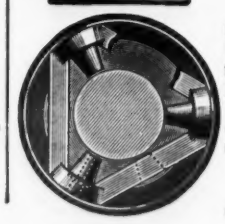
Almond Drill Chuck.
Sold at all Machinists Supply Stores.
T. R. ALMOND,
83 & 85 Washington St
BROOKLYN, N. Y.

L. S. STARRETT,
Manufacturer of
FINE TOOLS,
ATHOL, MASS.
SEND STAMP FOR FULL LIST.

TOOL AGENTS WANTED in every Shop in the United States. Send 10c. for Catalogue, Stationery &c.
THE FINEST OF MECHANICAL TOOLS A SPECIALTY.
C. B. JAMES, 98 Lake St., Chicago, Ill.



THE BROWNELL ANTI-FRICTION Step or Thrust Bearing
FOR
Lathes, Drills, Worm Shafts of Elevators or Hoists, Jack Screws, Mill Stones, Water Wheel and Propeller Shafts.
Bearings of all sizes made to order, and patent rights for sale by
G. L. BROWNELL,
WORCESTER, MASS.
Correspondence Solicited.



HALSEY'S PORTABLE POWER DRILL,

With Automatic Feed and Quick Return.
LIGHT. COMPACT. HANDY.

Specially adapted to Locomotive Engine and Boiler Work. Also for drilling and reaming bridge work.

Manufactured by
J. J. McCabe,

As applied for Drilling Engine Frames.

121 LIBERTY ST., N. Y.

WELDLESS STEEL TUBES — QUICK OPENING GATE VALVE. — **COLD DRAWN**
SMOOTH INSIDE & OUT.
JOHN S. LENG, 4 Fletcher St. N.Y.

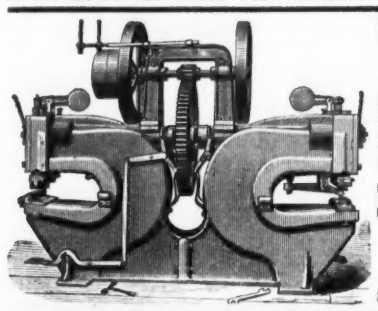
CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

MACHINISTS' FINE TOOLS.
STANDARD TOOL CO., ATHOL, MASS.
Catalogue and Price List free.

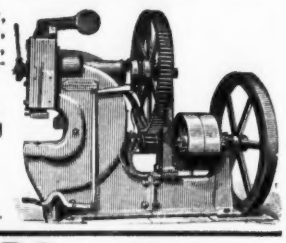
MASON REGULATOR
Every Engineer should write us for New Illustrated Pamphlet of our Steam Regulating Specialties: Reducing Valves, Pump Governors, Damper Regulators and Valves. Used by the leading houses of the world.
BOSTON.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

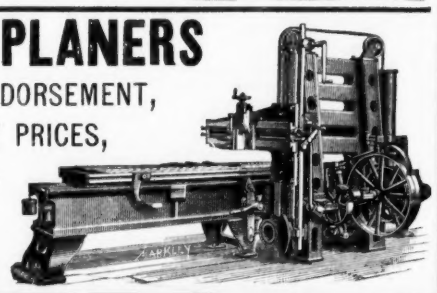
WILLIAM SELLERS & CO., Incorporated.
PHILADELPHIA, PA.
BUILDERS OF
MACHINE TOOLS FOR WORKING IRON AND STEEL,
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.



THE LONG & ALLSTATTER CO. Hamilton OHIO.
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
Punches and Shears,
OVER 300 SIZES.
ALSO
Power Cushioned Hammer.
Send for New Catalogue.



THE OPEN SIDE IRON PLANERS
GREATEST CAPACITY, HIGHEST ENDORSEMENT,
QUICK RETURN, MODERATE PRICES,
EXTRA HEAVY. QUICK DELIVERY.
DETRICK & HARVEY,
BALTIMORE, MD.



CASTINGS
Rough and finished to order. All kinds of castings in green or dry sand and loam. Large variety of gear and pulley patterns. Soft castings for finishing. *Patterns made to order.* Parties requiring work are invited to correspond with us before buying elsewhere. Estimates submitted on application.
THE ALLENTOWN FOUNDRY & MACHINE CO.,
3RD and WALNUT STS., ALLENTOWN, PA.

SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

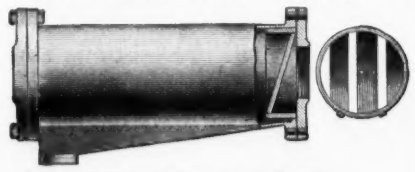
Can't slip. No wrench required. Made from 1-2" to 8" or larger. Send for sample order subject to approval.
MANUFACTURED BY
MIDDLETOWN (OHIO) MACHINE CO.

IMPROVED
15 and 20 INCH
Crank Shaper.
☞ Stroke changed while machine is running.
☞ Stroke adjusted while machine is running.
☞ Stroke positive, and will plane to a line.
☞ Work can be bolted to all sides of box table.
☞ Table removable, allowing work to be bolted to saddle on the cross rail.
☞ Indexed swivel vise, with centers.
☞ Large cones, ample power, plenty of metal, insuring stiffness.
☞ Accurate fitting; quality guaranteed.
☞ Also making 20", 26" and 32" geared shapers.
☞ Write for prices and full descriptions.
— THE —
LODGE & DAVIS MACHINE TOOL CO.,
CINCINNATI, OHIO.
WESTERN HOUSE:
68 & 70 SOUTH CANAL ST.,
CHICAGO.
EASTERN HOUSE:
64 CORTLANDT STREET,
NEW YORK.
See advt's, pages 15 and 16.

BOYNTON & PLUMMER,
WORCESTER, MASS.
Manufacturers of
Shaping Machines,
Drilling Machines,
Bolt Cutting Machines.
Send for Catalogue.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, ETC.

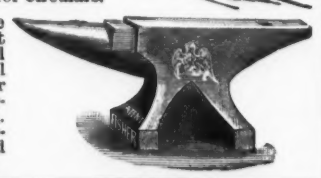
BARNARD'S SEPARATOR
For Separating and Removing Entrained Water from Live Steam;
AND
Condense Water, Oil, Dirt, Etc., from Exhaust Steam.
SPECIAL DESIGNS FOR SURFACE CONDENSERS.



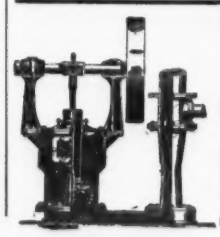
SEND FOR CIRCULAR AND PRICES.
GEO. A. BARNARD,
15 CORTLANDT ST., NEW YORK.

EAGLE ANVIL WORKS,
Trenton, N. J.

The Fisher Double Screw Leg Vise.—Warranted stronger grip than any other Vise. Always parallel and cannot be broken.
Send for Circulars.

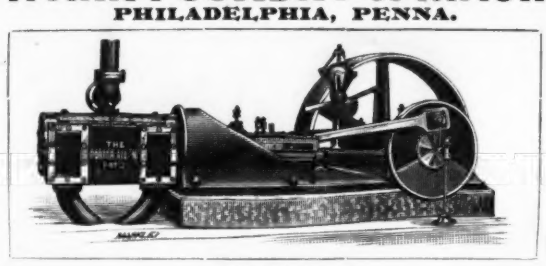


The Eagle Anvil.—Best Cast Steel Face & Steel Horn. Better than any English anvil. Fully warranted and lower price.



Belt Power Air Pump and Condenser.
CONOVER & CO.,
CONSULTING AND MECHANICAL ENGINEERS
219 MARKET ST.,
NEWARK, N. J.
No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
Adapted to all kinds of Engines. *Send for Circular.*

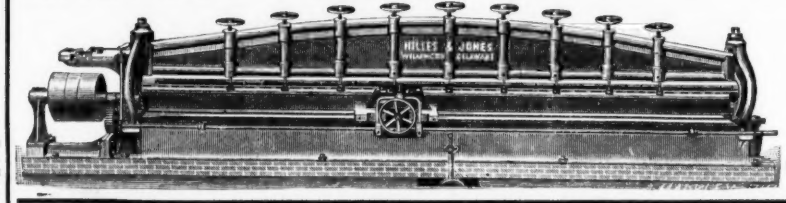
SOUTHWARK FOUNDRY & MACHINE CO.,
PHILADELPHIA, PENNA.
BOILERS. TANKS. STEAM HAMMERS. HEAVY CASTINGS.



BLOWING AND REVERSING ENGINES. CENTRIFUGAL PUMPS. STEAM PUMPS
SOLE MAKERS OF
PORTER-ALLEN AUTOMATIC ENGINE.
HIGH ECONOMY. DURABILITY. CLOSE REGULATION.

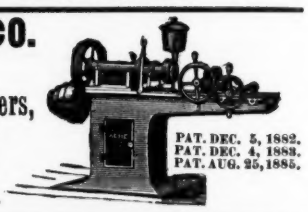
BEMENT, MILES & CO..
PHILADELPHIA, PA.
—BUILDERS OF—
METAL-WORKING MACHINE TOOLS
FOR
Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.

THE HILLES & JONES CO., WILMINGTON, DEL.,
MANUFACTURERS OF
MACHINE TOOLS, For Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc.



Improved Boiler Plate Planer.
Eight Sizes.
8'x20' length of cut.

ACME MACHINERY CO.
CLEVELAND, OHIO.
Manufacturers of "ACME"
Single & Double Automatic Boltcutters,
Cutting from 3-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
Send for Catalogues and Discounts.
FIRST PREMIUM, CINCINNATI CENTENNIAL.



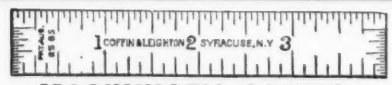
PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.

All GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS.

PHOSPHOR-BRONZE
INGOTS, CASTINGS & MANUFACTURES.
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

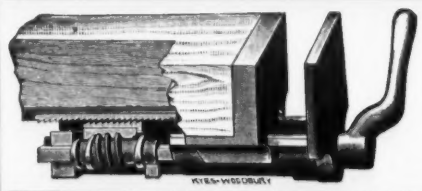
THE AERATED FUEL COMPANY,
425 MAIN STREET, SPRINGFIELD, MASS. J. H. BULLARD, MANAGER.
FORGING AND WELDING BY PETROLEUM AIR BLAST.
ALL OIL BELOW BURNERS! NO SMOKE, DIRT, OR ASHES!
Represented by WILLIAM PICKETT, SON & CO., 170 Lake Street, Chicago; and St. Louis. Sept. 29, 1885.
W. S. COLLINS, 171 Broadway, New York. CHILION JONES, Gananoque, Can. G. M. SMITH, July 5, 1887.
Los Angeles, Cal. ALDEN SPEARE'S SONS & CO., 3 Central Wharf, Boston. KALAMAZOO Feb. 5, 1889.
SPRING AND AXLE CO., Kalamazoo, Mich. DUNKIRK ENGINEERING CO., Dunkirk, N. Y. July 23, 1889.
☞ We will replace in Stock or Mutual Companies any Insurance canceled on account of using this System, when installed according to our plans.

MACHINERY
For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information, address the Manufacturer,
S. W. GOODYEAR, Waterbury, Ct.



MACHINIST'S SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

SOUND STEEL CASTINGS
THE BOOKWALTER CASTING CO.
Are now fully prepared to furnish **Steel Castings** on short notice, of any size and pattern, made under the **BOOKWALTER AND ROBERT PATENTS.** These castings are guaranteed to be sound and true to the pattern, and of unequaled tensile strength and ductility. Address
The Bookwalter Casting Co., Springfield, O.



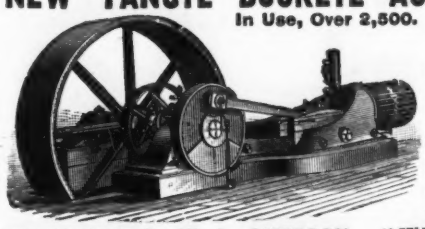
QUICK-ACTION VISES,
For Pattern Makers and Wood Workers.
WYMAN & GORDON,
WORCESTER, MASS.
DROP FORGINGS.

BALL AUTOMATIC CUT-OFF ENGINES,
ERIE, PA.
The characteristics of these Engines are Beauty of Design, Superior Finish, Limited Feet in Space required, Economy of Fuel, Perfection of Regulation.
CHARLES R. VINCENT & CO.,
NEW YORK SELLING OFFICE, 15 CORTLANDT STREET.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 2,500.

25 to 1,000 H. P.



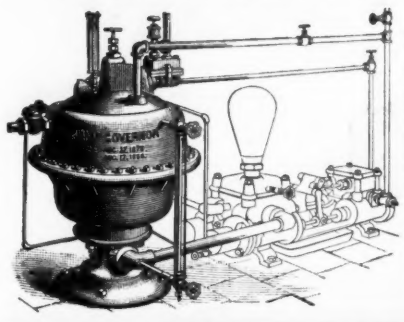
These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H. P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: W. L. SIMPSON, 10 TELEPHONE BUILDING, } N. W. ROBINSON, 154 Washington St., Chicago, Ills.
18 CORTLANDT STREET, N. Y. } ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

BLESSING'S PUMP GOVERNOR.

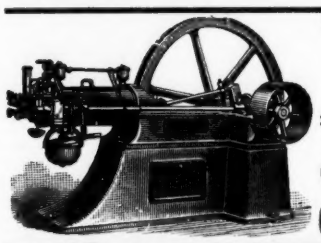


For use in returning the water of condensation to steam boilers under circumstances which make the employment of the steam trap undesirable, as where the pressure in heating systems is greatly reduced below boiler pressure, or where sufficient head room is lacking. Is used in connection with a steam pump, so controlling the action of the pump that its piston speed is at all times exactly proportionate to the varying quantity of water to be returned. No stuffing boxes are used in its construction, and friction is reduced to a minimum. Can be adapted to suit a wide range of conditions.

Send for circular of **Blessing's Albany Steam Trap, Blessing's Water Circulator and Purifier, and Blessing's Renewable-Seat Stop and Check Valves.**

ALBANY STEAM TRAP CO., Albany, N. Y.

"OTTO" GAS ENGINE WORKS.



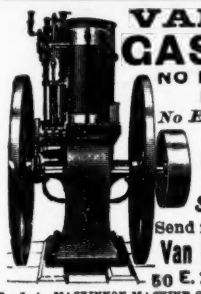
SCHLEICHER, SCHUMM & CO.,

33d and Walnut Sts., PHILADELPHIA. Branch Office, 151 Monroe St., CHICAGO.

OVER 25,000 ENGINES IN USE.

GUARANTEED To consume 25 to 75 Per Cent. Less Gas than ANY Other Gas Engine doing the same work.

VAN DUZEN GAS ENGINE



NO BOILER. NO COAL. NO ENGINEER.
No Extra WATER RENT or INSURANCE.
INSTANTLY STARTED.
DURABLE, RELIABLE, SAFE and ECONOMICAL.

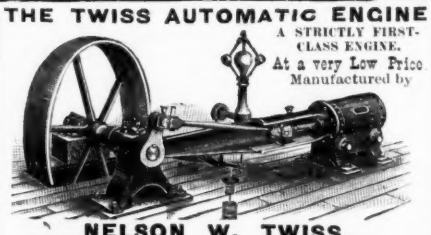
Send for description and prices

Van Duzen Gas Engine CO.,
50 E. 2nd St., CINCINNATI, O.

The J. A. MACKINNON MACHINE CO., Agents, 22 Warren St., N. Y.

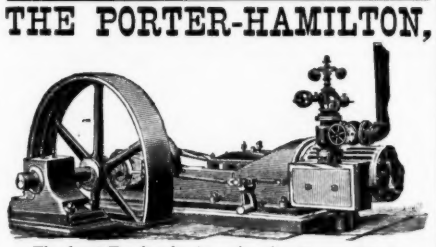
THE TWISS AUTOMATIC ENGINE

A STRICTLY FIRST-CLASS ENGINE.
At a very Low Price Manufactured by



NELSON W. TWISS,
25 Whitney Ave., New Haven, Conn.
Send for Price before Purchasing Elsewhere.
ALSO VERTICAL AND YACHT ENGINES.

THE PORTER-HAMILTON,



The best Engine in America for Heavy Work.

WILLIAM TOD & CO.,
Youngstown, Ohio.

Every Mechanic should have a

KENNELLY'S PROTRACTOR.

THEY ONLY COST $1.
Send for a Circular to
MONTGOMERY & CO.,
105 FULTON ST., NEW YORK CITY.

J. A. FAY & CO. CINCINNATI, OHIO, U.S.A.

BUILDERS OF IMPROVED

WOOD-WORKING MACHINERY

Embraces nearly 400 Machines for

PLANING & MATCHING

Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, etc.

Variety and Universal

WOOD WORKERS.

Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.

W. H. DOANE, Pres. D. L. LYON, Sec'y.

MACHINERY ON HAND.

22 in. x 5 ft.	Planer.	W heeler,	new.
24 in. x 5 ft.	"	N. H.	good order.
24 in. x 6 ft.	"	Powell,	new.
26 in. x 8 ft.	"	Pond,	good order
30 in. x 8 ft.	"	each Atherton, Powell & H. & P.	new.
9-12 in. Shaper,		H. & P.	good.
12 in Crank Shaper,		Jengst,	new.
12 in " "			cheap
6-8-10-12-15 in. Crank Shapers			
15 in. Hendey Shaper,			good.
15x20 in. Friction Shapers.			
20-24-26 and 32 in. Geared Shapers.			
11 in. x 5 ft. Engine Lathe,			
14 in. x 6 ft.	"	Blaisdell & Prentice Bros.	new.
14 in. x 7 ft.	"	Bogert,	"
16 in. x 8 ft. Engine Lathe, with Turret Head,		Putnam,	A 1.
15 in. x 6 and 8 ft.	"	Porter,	new.
16 in. x 6 and 8 ft.	"	McMahon,	"
18 in. x 8 ft.	"	Blaisdell,	new.
16-20 in. x 6-8-10 & 12 ft.		Bridgeport,	"
18 in. x 8-10-12 ft.	"	Different Makes,	"
20 in. x 8-10-14 ft.	"	Different Makes,	"
20 in. any length Bed	"	Bridgeport,	"
30 in. x 12 ft.		Wheeler,	fair.
24 in. x 8-10-12	"	Bridgeport,	new.
24 in. x 12 ft.	"	Blaisdell,	"
24 in. x 16 ft.	"	New Haven,	cheap.
26 in. x 11 ft.	"		"
26 in. x 12 ft. Engine Lathe,		Pond,	good order.
28 in. x 14-16 & 18 ft. Engine Lathes,		F. & S.	new.
32 in. x 16 ft. Engine Lathe,		Fay & Scott,	"
26 & 50 inch Pulley Machine,		Stevens,	good.
Bement Car Axle Lathe,			"
20 in. Drill Lever,		Reed,	"
20 in. Drill		Davis,	new.
20-23-25-28 inch Drills		Blaisdell,	"
20-25-28-32 inch	"	C. & S.	"
Cabinet Turret Lathe, Lodge, Davis & Co.			new.
No. 3 Screw Machine, Brown & Sharpe.			cheap.
Ames Index Milling Machine,			fair.
No. 1 and 3 Universal Miller, Brown & Sharpe,			new.
No. 1 Pulley Set Screw Machine, Newton,			
Lincoln Pattern Miller,			good order.
24 in. Chucking Lathe,		Harrington,	good as new.
20-33-49 in. Turret Chucking Mch.,		Bridgeport,	new.
37 & 51 in. Vertical B. & P. Mill,		Bridgeport,	"
10 in. stroke Slotter,		H. & P.	A1.
Warren's Die Sinking Slotter,			good as new.

Cold Rolled Shafting in Stock. Send for List. Write for what is wanted.

E. P. BULLARD,
62 College Place and 72 Warren Street, New York.

OUR NEW

15 in. BORING LATHE

☞ If you are boring cast, malleable iron, steel or brass, on Engine Lathes, you are losing money. You should use Boring Lathes.

☞ If you have thousands of small pieces to duplicate with absolute accuracy, use this Lathe.

☞ If you are making small valves or pet cocks, this is the Lathe for the purpose.

☞ If you wish to cut off thousands of pieces and shape or size the ends, this is the tool.

☞ If you are using old-style machinery for duplicate work, you are losing money.

☞ An inexperienced boy can handle the Lathe.

☞ Turret is operated by lever or screw.

☞ Spindles of crucible steel that may be run at almost any speed without heating.

☞ Is provided with journals that will wear a lifetime.

☞ Has large cones for wide belts.

☞ With this tool you can meet any competition on your work.

☞ The price is low. Write for cut and description.

We make Turret Boring Lathes 12", 13", 15", 16", 19", 21", 36" swing.

— THE —

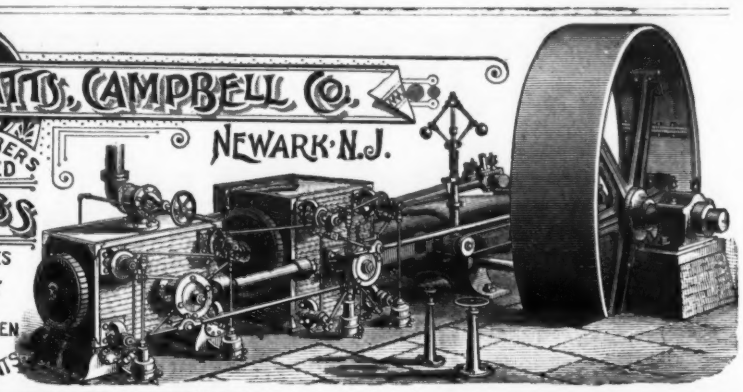
LODGE & DAVIS MACHINE TOOL CO.,
CINCINNATI, OHIO.
WESTERN HOUSE:
68 & 70 SOUTH CANAL ST.,
CHICAGO, ILL.
EASTERN HOUSE:
64 CORTLANDT STREET,
NEW YORK.

See advts pages 14 and 16.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED **CORLISS** STEAM ENGINES IN FULL VARIETY.
CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.

NEWARK, N.J.



Eclipse Corliss Engine.

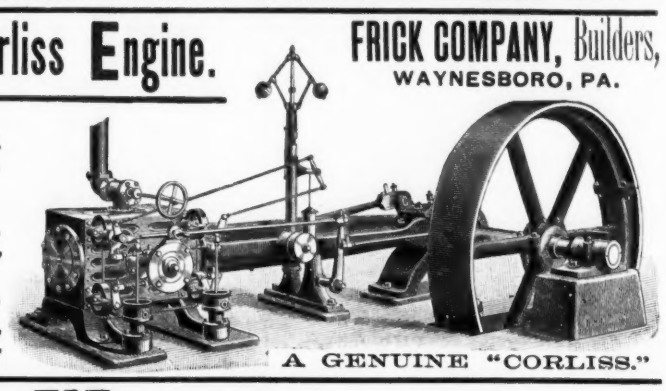
FRICK COMPANY, Builders,
WAYNESBORO, PA.

NON-CONDENSING,
CONDENSING COMPOUND,
40 TO 1,000 H.P.

Send for Circulars.

E. P. HAMPSON & CO.,
36 CORTLANDT ST.,
NEW YORK,
Sole Eastern Agents.

JOHN J. METZGER,
69 S. Clinton St., Chicago,
WESTERN AGENT.



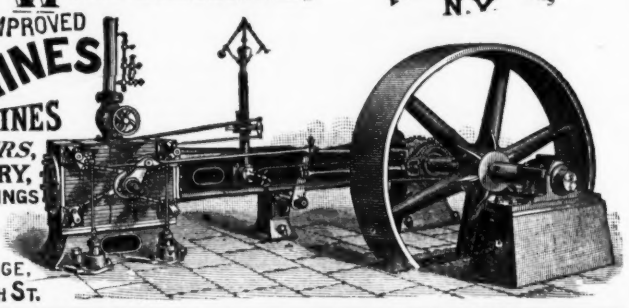
A GENUINE "CORLISS."

ROBERT WHITEHILL,

NEWBURGH N.Y.

MANUFACTURER OF IMPROVED
CORLISS ENGINES
ALSO
SLIDE VALVE ENGINES
STATIONARY BOILERS,
GENERAL MACHINERY,
IRON AND BRASS CASTINGS.

NEW YORK OFFICE
ROOM 6,
COAL AND IRON EXCHANGE,
COR. CORTLANDT & CHURCH ST.



STEARNS M'F'G CO.

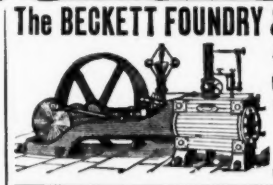
ERIE, PA.

ENGINES from 15 to 400 Horse Power
Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogue.

SAW MILLS AND GENERAL MACHINERY
NEW YORK STORE, 46 Cortlandt St.

The BECKETT FOUNDRY & MACHINE CO.,

ARLINGTON, N. J.
Manufacturers of
The "MUNZER" Corliss Engine.



SEND FOR CATALOGUE.

Something New!
One, two, three, and four spindle drills for light work.

DRILLS

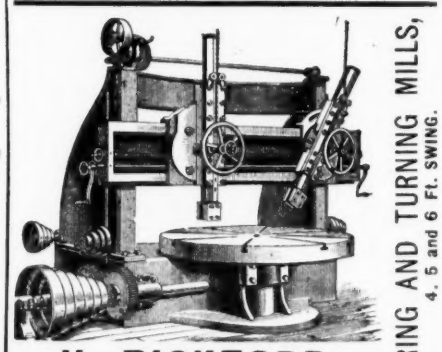
The most useful patented improvement in drill presses for years is applied.

SENSITIVE

Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the **latest** and **best.** Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.
HARTFORD, CONN.



H. BICKFORD,
LAKE VILLAGE, N. H.

BORING AND TURNING MILLS, 4, 5 and 6 Ft. SWING.

LATHE

FOR
TOOL MAKING,
MODEL MAKING,

Waltham, Mass.

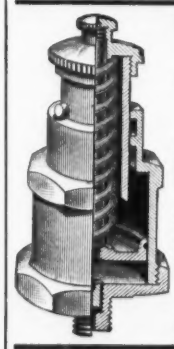
SCREW CUTTING, GRINDING AND EXTRA FINE WORK.
SEND FOR BOOK OF DESCRIPTION.

ESTABLISHED 1842.

ROBERT POOLE & SON CO.

ENGINEERS AND MACHINISTS.
MACHINE MOULDED
GEARING.
ALL KINDS OF TRANSMISSION MACHINERY
OF THE HEAVIEST CLASS.
BALTIMORE, MD.

LACKAWANNA GREASE CUP



Will Save its Cost in Oil alone Several Times per Annum.

SAVES ALSO IN LABOR, AND COST OF COTTON-WASTE. PREVENTS DRIPPING AND SPATTERING.

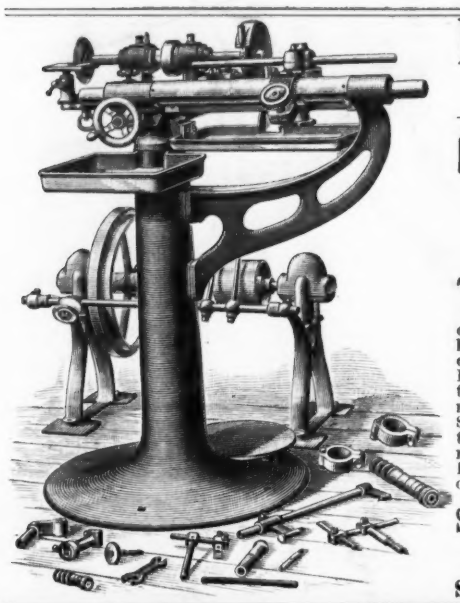
A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

Lackawanna Lubricating Co.,
41 Coal Exchange, Scranton, Pa.

PATENTS

THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide

3/8" **FLEXIBLE METALLIC FILLET**
For Pattern Makers' Use.
H. WHITE, 44 N. 4th Street, Phila., Pa.



Brown & Sharpe Mfg. Co.

PROVIDENCE, R. I.

No. 3 UNIVERSAL CUTTER AND REAMER GRINDER.

Patented Nov. 3, 1885; *March* 22, 1887.

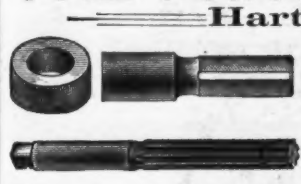
THIS machine is extensively used for sharpening straight or taper, shell or shank reamers, and for grinding edge and bevel cutters of any angle, straddle and face mills, cotter and hollow mills, and straight or taper milling cutters, cut either straight or spiral, with holes or shanks. It can also be used for sharpening worm or thread tools. All moving parts are adjustable. Movements quick and accurate, simple and mechanical. Spindle has two speeds. Distance between centers, 12". Mills or shell reamers 6" diameter and not over 6" long can be satisfactorily ground. Emery wheels used up to 7" diameter, either with or without water.

Special Pamphlet mailed on application.

WESTERN AGENT,
S. A. SMITH, 23 S. Canal St., Chicago, Ill.

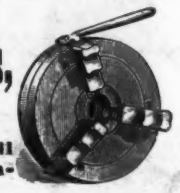
THE PRATT & WHITNEY CO.

Hartford, Connecticut.



MANUFACTURE STANDARD SIZE

Cylindrical and Caliper Gauges,



And End Measure Test Pieces.
Straight and Taper Solid Hand Reamers, Chucking and Shell Reamers, Arbors and Steel Mandrels, Taper Pin Reamers, Combination Lathe Chuck.

PRICE LIST AND DISCOUNT SHEET SENT UPON APPLICATION.
WESTERN BRANCH, 100 West Washington Street, Chicago, Ills.

THE BILLINGS & SPENCER CO., *HARTFORD, CONN., U. S. A.*

Manufacturers of Beach's Improved Patent Thread Cutting and Diamond Point Lathe Tool.

FURNISHED IN TWO SIZES, EITHER SIZE WITH BENT OR STRAIGHT HOLDER.

WE FURNISH CUTTERS FOR U. S. S. THREADS TO FIT THESE TOOLS.

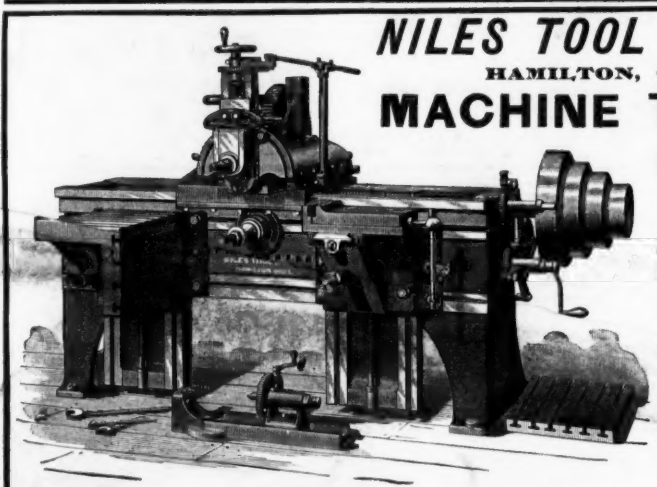
Send for Catalogue.

DROP FORGINGS OF BRONZE, COPPER, IRON & STEEL OF ALL DESCRIPTIONS.

NILES TOOL WORKS,

HAMILTON, OHIO.

MACHINE TOOLS.



SHAPING MACHINES.

TRAVELING HEAD.

16, 18 and 24 inch Stroke.

Extra heavy and powerful.

NEW YORK, 98 Liberty St. **PHILADELPHIA,** 705 Arch St. **CHICAGO,** Phenix Building. **PITTSBURGH,** Penn Building.

WARNER & SWASEY,

CLEVELAND, OHIO,

MACHINE TOOLS

For Iron and Brass Work.

SMALL TOOLS & FIXTURES.

Gear Cutting in all its Branches.

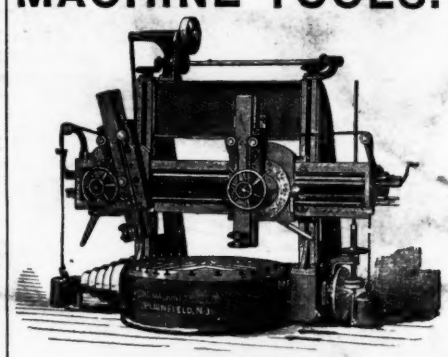
ILLUSTRATED CATALOGUE ON APPLICATION.

THE POND MACHINE TOOL CO.,

Formerly of Worcester, Mass.

MANUFACTURERS OF

MACHINE TOOLS.



BORING MILLS.

Radial Drills, Planers, Lathes, Heavy & Powerful, from new patterns of the latest and best designs.

SALESROOM & OFFICE, 113 Liberty St., N. Y. City.
NEW SHOPS, PLAINFIELD, N. J.

GRANES

THE YALE & TOWNE MFG CO.,
STAMFORD CONN
NEW YORK. CHICAGO. PHILA. BOSTON

JENKINS BROS.' VALVES.

JENKINS Every valve tested and warranted, all parts interchangeable. Nothing but best Steam Metal used in the manufacture. The Diamond-eyed Stuffing Box and Disc Removing Lock Nut is used only in the Jenkins Bros.' Valves. None are genuine unless stamped with "Trade Mark." Should you order INSIST on having Jenkins Bros.' Valves.

71 JOHN STREET, NEW YORK. *54 DEARBORN STREET, CHICAGO.*
21 NORTH FIFTH STREET, PHILA. *105 MILK STREET, BOSTON.*

GEO. W. FIFIELD,

Manufacturer of ENGINE LATHES from 16 to 48 in. Swing. Cuts, Photographs and Prices furnished on application.
Lowell, Mass., U. S. A.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, PRESIDENT.
WM. B. FRANKLIN, VICE-PRESIDENT.
F. B. ALLEN, SECOND VICE-PRESIDENT.
J. B. PIERCE, SECRETARY & TREASURER.

THE GREAT SUCCESS

Attending the sale of our **IMPROVED MACHINE TOOLS** in the East has decided us to open, January 1st, 1890, a

NEW MACHINERY STORE

—AT—

64 Cortlandt St., New York,

Under the management of W. H. HARRISON, late with E. P. BULLARD.

WE WILL CARRY A FULL LINE OF NEW DESIGNS OF

IRON AND BRASS WORKING MACHINERY.

☞ **Come and see us before buying.**

THE LODGE & DAVIS MACHINE TOOL CO.,

NEW YORK. CHICAGO. CINCINNATI.

See advertisements, pages 14 and 15.

GEAR WHEELS AND GEAR CUTTING.

LEXINGTON GEAR WORKS, LEXINGTON, MASS.
BOSTON GEAR WORKS, 137 HIGH ST., BOSTON.
(GRANT) **SEND FOR CATALOGUE.**

Key-Seating Machines and 20 in. Drills

A SPECIALTY.

SEND FOR LIST OF

New and Second-Hand

Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

W. P. DAVIS,
Rochester, N. Y.
Works at North Bloomfield.

THE G. A. GRAY CO.

Cincinnati, Ohio.

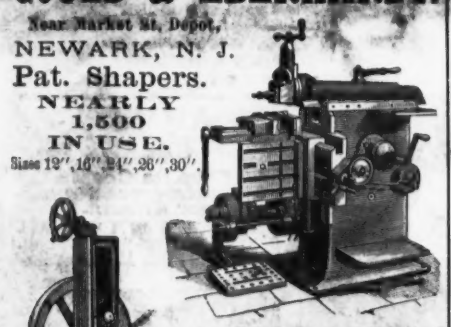
PLANERS AND LATHES

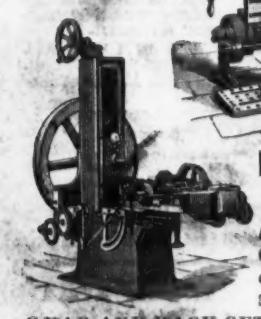
A SPECIALTY.

GOULD & EBERHARDT.

Near Market St. Depot,
NEWARK, N. J.

Pat. Shapers.
NEARLY 1,500 IN USE.
Sizes 12", 16", 24", 26", 30".



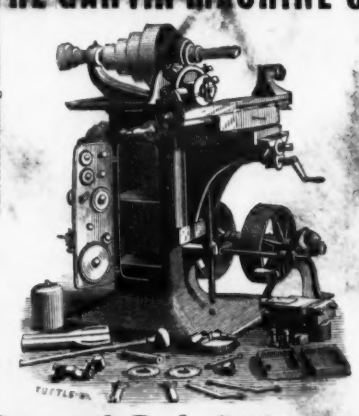


EBERHARDT'S Patent.
The *ONLY ENTIRELY AUTOMATIC* Gear Cutter built, without exception.
Sizes 22", 25", 30", 50", 60".

GEAR AND RACK CUTTING TO ORDER.

THE GARVIN MACHINE CO.,

Universal Milling Machine.



Manufacturers of Machinists' and Iron Workers' Tools, Lathes, Planers, Milling Machines and Drills. Special Tools for all kinds of manufacturing to order.

Gear and Rack Cutting, Milling and Index Drilling to Order.

LAIGHT & CANAL STS., NEW YORK.

STEEL CASTINGS.

PRATT & LETCHWORTH,
PROPRIETORS
BUFFALO STEEL FOUNDRY,
BUFFALO, N. Y.

2½" Cutting-Off Machine. 20" × 6' Chucking Lathe. 27" × 27" × 8' Planer.

THE HENDEY MACHINE CO

TORRINGTON, CONN.

SEND FOR OUR CATALOGUE

MANUFACTURERS OF **MACHINE TOOLS**

J. M. CARPENTER PAWTUCKET, R. I.

Manufacturer —of— **TAPS & DIES**